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HUSBANDRY
OF
SCOTLAND.

SKETCH OF
CHAPTER II.

ON THE
PRACTICAL DETAILS
OF THE
SCOTCH SYSTEM
OF
HUSBANDRY.

BY
SIR JOHN SINCLAIR, BART. M. P.
PRESIDENT OF THE BOARD OF AGRICULTURE.

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TO THE READER.

BEFORE the following detailed account of the improved System of Husbandry adopted in Scotland, is communicated to the public, I feel it incumbent upon me, to give the intelligent Farmers of that part of the united kingdom, from whom my information has been derived, an opportunity of considering it, that the risk of any material error may be prevented.

It would be impossible indeed, for one immersed in such a multitude of avocations, to hazard any publication on so important a subject, without having it previously considered by some intelligent friends, who will take the trouble of examining it, in the state of what may be called *printed manuscript*; and for the purpose of being favoured with their valuable remarks upon it, this paper is printed for circulation.

It is therefore requested, that the reader, as soon as he can find leisure, thoroughly to examine the paper, will please return it with his remarks, (*in packets under an ounce weight*, if residing at a distance from Edinburgh), addressed to Sir JOHN SINCLAIR, Bart., M. P. Charlotte Square, Edinburgh.

25th July 1810.

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SKETCH OF
CHAPTER II.

ON THE PRACTICAL DETAILS OF THE SCOTCH
SYSTEM OF HUSBANDRY.

I HAVE always been of opinion, that however mysterious the science or art of Agriculture has hitherto been considered, yet that it might be reduced to a few simple principles, and in many respects brought to almost mathematical precision. The reason why that has not yet been effected to the extent of which the subject was capable, is, either that real practical men have rarely published the result of their experience and observation on agricultural questions, or that those who have written their sentiments, have seldom entered sufficiently into detail, so as to explain what may be called "*the Mysteries of Agriculture*," or those minute operations, on the due execution of which its success must in a great measure depend. Besides, it is only within these few years that a judicious and economical System of Agriculture has been extensively carried into practice, or the principles on which it ought to be conducted has been thoroughly ascertained. By the improvements, however, which have lately been introduced into that art, (which the minute inquiries carried on under the auspices of the Board of Agriculture, have fortunately brought to light), the principles are established, on which the territory of any country, at least of one possessing a soil and climate similar to Great Britain, may be cultivated with profit and success.

It may easily be supposed, that a person engaged in so many other occupations, could not have acquired suffi-

cient personal knowledge of the agricultural practices of any extensive tract of country, to have hazarded such a work as the present, grounded on his own personal experience alone ; but having had the satisfaction of receiving, from a number of the most intelligent farmers in Scotland, the most direct and valuable returns, of the state of their different possessions, and the manner in which they are respectively cultivated, he hopes it will be in his power to give a just and authentic account of the system on which agriculture is carried on in the more improved districts of North Britain.

It may be proper, at the same time, to observe, that the present inquiry is confined to lands strictly speaking *arable*, or subject to the convertible system of husbandry, and that farms purely grazing do not come within the scope of the present inquiry.

I. POSITION OF THE FARM-HOUSE AND OFFICES.

The first point that any judicious farmer would resolve to ascertain, in regard to any farm he would wish to occupy, (more especially if it was of any extent, namely, from 300 to 500, or 1000 acres), would be, whether the farm-house and offices were properly situated, and erected as nearly as possible in the centre of the farm. In many cases, this would make a difference in point of rent of from 5 s. to even 10 s. *per acre*. The difference is calculated by some intelligent farmers, as the expence of a plough, or L. 100 *per annum*. If a house is placed in the corner of a large farm, a part of it will often be neglected by the farmer ; less manure will be sent to it ; the expence of cultivation is materially increased ; the horses have their strength uselessly wasted in going backwards and forwards, and the remote part of the farm is left in what in Scotland is called an *outfield* or *after-*

well state, that is to say, in miserable pasturage occasionally broken up.

In the improved districts of Scotland, this is a point as much attended to as the circumstances of the case will admit of, more especially when any new buildings are constructed *. How different from that state of feudal barbarism, (which may still be found in some districts in England), where all the farm-houses of a parish were collected into a village, for the sake of mutual protection and defence, and where all the neighbouring fields were cultivated in common.

There can only be one reason for having the farm-house and offices not in a central position, and that is, where a threshing-mill is to be driven by water †, and, in some cases, where wind cannot be commanded near the centre. That however is only an exception to the general rule; for it may be laid down as an axiom in agriculture, "*That the farm-house and offices, ought always to be placed, as nearly as possible, in the centre of a farm.*"

Where the circumstances of the case will admit of it, the farm-house and offices should front the south, and should also be placed *on an elevated situation*. It is not only healthier for the farmer, his family, and his servants, but carts will bring home the corn in harvest time, with least waste, when going up hill, and when empty, it can

* It is remarked by an intelligent gentleman in England, that the farm buildings in Scotland are in general much more convenient than those in England. In a large farm there is the difference of at least the labour of one man throughout the year, between a convenient and inconvenient set of offices.

† The only objections to water threshing-mills are, that they are useless in time of frost, and in some places are liable to be overrun by water rats. The subject of water threshing-mills will be after more fully discussed.

return to the harvest field, by a gentle trot, which will much expedite the getting home and securing the farm produce. The manure from the farm-yard so situated, will all be conveyed down-hill to the fields in the cheapest and most expeditious manner*.

2. THE BEST CONSTRUCTION OF A FARM-HOUSE AND OFFICES.

This is a most material point for the consideration both of the farmer and of the landlord, and the rent to be paid, ought certainly in some measure to depend on the goodness of the accommodations with which the occupier is furnished. With convenient offices, it is evident that the grain produced on the farm, can be better preserved, and more advantageously separated from the straw, and prepared for market. The live stock also on the farm, can be more easily and regularly fed, and being thus kept in better order, must consequently be fitter for their work, or for the market. The propriety also of having suitable accommodations for the farmer, his family and his servants, need not be dwelt upon. The expence of erecting such buildings must be considerable when first laid out, but no liberal landlord will grudge it for the comfort and advantage of an industrious tenant, who pays an adequate rent †. Every convenience afforded to the farmer, for enabling him to carry on his business with as little expence and to as much advantage as possible, must

* From a communication by W. Money Hill, Esq; of Waterden, in Norfolk.

† Even *minutiae* may be of great consequence to a tenant; for instance, in the erection of barns; more especially if the walls are rough, it is of importance to have a projecting stone or brick at every aperture for the admission of air, to prevent the access of vermin; and in laying the foundation of barns, that material object, (the exclusion of vermin), ought always to be kept in view.

indeed greatly enhance the value of the farm, and will insure to the landlord, should he have occasion to seek for a new tenant, abundance of competitors from among the most intelligent husbandmen in the neighbourhood; for that situation.

Where convenience and utility are the objects principally attended to, it is recommended by an intelligent agriculturist in Roxburghshire, who has had great experience in the erecting of such buildings, (Mr Walker of Wooden,) to have the farm-house of three stories, the kitchen-storey half sunk. This makes the house itself drier, and saves the expence of roofing; an engraving of that plan is herewith given. He adds, that he has made plans of farm-houses, both of that construction, and with only two stories, having the kitchen and dairy behind; but he knows that the house of three stories gives most satisfaction to the occupier. Others object to this plan, and prefer a wing and back jamb. In the half-sunk kitchen storey, besides the danger of dampness, it is impossible to shut out the din of the kitchen, where, in the evenings, the unmarried lads must necessarily be along with the women.—It is besides, more troublesome to the farmer's wife to be continually going up and down stairs.—Hence a wing or back jamb is preferred by many farmers.

In regard to the expence of erecting new farmsteads, it cannot be properly estimated, as the price of building, and the expence of the materials, vary in every district. In some publications it is stated at from two and a half to three years rent of the farm. It is evident, at the same time, that the landlord can afford a higher allowance, where he receives a considerable rent.

Regarding farm-houses and offices, the following axioms may be laid down, as principles which ought to be kept in view, when such buildings are to be erected.

1: The house and offices should be on a scale proportionate to the size and produce of the farm, having uti-

lity and not ornament in view. Not only the original cost, but the very expence of keeping unnecessary buildings in repair, is a heavy burden upon any property, which it is for the interest both of the landlord and of the tenant to avoid. The house and offices should afford ample convenience to the farmer in carrying on his business. On the other hand, all superfluous buildings, and useless decorations, ought to be avoided; for, as Dr Coventry has well observed, durable economy should be preferred to shifting taste *. Nothing can be more absurd than the enormous barns usually attached to all the great farms in England. Grain in the straw keeps infinitely better in the open air than in close barns; it is less apt to be destroyed by vermin, and saves the enormous expence of building and repairing great barns. Threshing mills, when generally introduced, will soon prove the absurdity of much useless erections.

2. The accommodations really necessary, ought never to be straitened in regard to room. The threshing-barn, for instance, must be sufficiently spacious to contain two stacks of grain in the straw; and the straw-barn, as recommended by Mr Walker of Wooden, should be so large as to pile up the whole of that straw when threshed, so that a considerable quantity of straw may always be kept in good order for fodder. Where cattle are fed on straw, (which it would be better to dispense with, if richer food, as will afterwards be explained, could be provided for them), the farmer would otherwise be obliged to thresh more frequently than he would wish to do. There ought to be a granary adjacent to the barn, in which the grain, when threshed,

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* See Discourses on Agriculture, p. 5.

may be put, the lower part of which will furnish space for a cart-shed, which ought to be large enough to hold two carts for every plough. The size of the stables, cow-houses, and feeding-sheds, must depend on the manner in which the farm is occupied; in particular, as to the feeding-sheds, whether it is most advantageous to rear young cattle for the grazier, or to fatten older stock for the butcher; but it is a rule that ought never to be departed from, not to scrimp them in point of space, but to give the stock ample accommodation.

3. It is highly expedient that the farmer should see from a window in that room where he usually sits, what is going forward in the farm-yard, the very idea of which keeps the servants in awe, and may often prevent negligence and depredations.

4. The house should be situated a little out of the line of the square, but in general should form one of the sides, unless where the house is erected as an ornament to the neighbourhood. The three sides of the offices should be separated from each other by gates, which would not only be an accommodation to the yard, but would be useful in case of fire, by which infinite damage might be done to a farmer, without such a precaution. Such a separation also greatly obstructs the increase of vermin*.

5. It is of great importance to have either a paved street, or a good road, all round the farm-yard and dung-pit. Farmers suffer more by having their carts and cattle struggling in farm-yards through piles of straw and

* In exposed situations, and cold climates, these gates may be objected to, even though the gable-ends of the back-wing are on a line with the back of the others.

dung where this is neglected, than is commonly imagined.

6. It is also highly expedient to have two reservoirs for urine. As soon as one is full, it should remain in that state to ferment, previous to its being taken away, and the other in the mean time may be filling. This plan is strongly recommended by Mr. Allan of Craigmuck, near Edinburgh. It is likewise proper, in order that the urine may be as strong as possible, and to prevent an accumulation of wet, that the buildings should not admit water to go inwards from the roof, or it should be taken away by spouts and drains *.

7. It is evident that the access to the house and offices should be as commodious as possible. The road should be kept in good order. The corners of the garden and inclosures to be rounded instead of square, by which many accidents may be prevented, injurious both to the carts and to the cattle.

8. A command of water is essential; it is desirable, therefore, that the house should be situated near some river or stream; but if that cannot be obtained, ponds and wells, and the means of conveying water by troughs to the feeding-houses, both for horses and cattle, and to the dairy, are essential. Nothing can be more injurious to stock, than to compel them to drink at ponds full of every nastiness, which the farmer ought to appropriate to useful purposes.

9. As an appendage to farm-houses, a kitchen garden is of infinite importance, and may be more profitable to

* It is said, that where abundance of litter is given in the yards, it hardly ever happens that too much wet gets to them, and that there is sometimes a want of moisture in dry winters. This ought to be provided for.

the occupier, than any part of his farm. This is certainly less essential, since potatoes, turnips, and other articles have been cultivated in the fields ; but still, it is expedient for a farmer, for a variety of other articles, to enable him to try experiments, with new plants, on a small scale ; to train up his rising family to an attention to such objects, and to furnish his table with small domestic luxuries, which no farmer would be willing to purchase, if he can procure them at home.

Attending to these principles, the annexed sketch has been drawn up, pointing out the proper position of farmhouse and offices ; together with the plan of a farm which is probably as perfect as any that has hitherto been suggested.

It would be entering into too wide a field to dwell on the various offices necessary for the accommodation of a large farmer, more especially, as that subject is very fully detailed in a valuable paper, printed in the communications to the Board of Agriculture *, and will be fully explained in the general report on the agricultural state of Scotland, now preparing to be laid by the Board of Agriculture before his Majesty, and both Houses of Parliament ; but it may be necessary to dwell on one point, regarding the construction of convenient places for feeding cattle, for the purpose both of consuming the turnips, and the straw raised on the farm ; and for converting the surplus straw into dung. Three plans have been formed for that object : The 1st, is to feed them in open large yards ; the 2d, in feeding-houses,

* See a paper on Farm-buildings in general, by Robert Beatson, Esq; Communications to the Board of Agriculture, vol. i. p. 3.

and the 3d, in open sheds, or what, in Berwickshire, are known under the name of *Hammels*, or *Hemmels* *.

The plan of fold-yards is certainly the cheapest, being in general formed by the offices which afford shelter to the cattle; but where a number of animals, of all sorts and ages, are suffered to mingle together, many accidents must happen, and the cattle must often be injured, by going through a yard full of straw and dung, and often very deep, in which they must frequently sink. Though this plan might answer for young cattle, where divisions are made by walls or hurdles, yet it would never answer for feeding valuable cattle for the butcher.

In a well-regulated extensive farm, employed in the convertible husbandry, it is contended, that fold-yards, divided for stock of different ages, are indispensably necessary, as no farm can possibly feed the whole cattle-stock during winter, which is requisite for grazing in summer. This important question will be afterwards discussed.

Feeding-houses are, in some respects, well calculated for fattening cattle. The animals are kept warm and quiet, and each can have the portion of food allotted to him; but the animals having no exercise when thus stalled, become unhealthy, the meat unwholesome, and the legs of cattle, when confined to one spot, are so apt to swell, that they are unable to go to market.

On the whole, the 3d plan seems to me the best; namely, that of hammels, which I first had the satisfaction of seeing, at Mr Robertson's of Ladykirk, in Berwickshire.

* It is said, that this is an English word, and hence that Hemel-Hampstead is derived. But Hammel is probably derived from *ham*, a habitation.

An engraving of this excellent plan is annexed, which will give an idea of the form of the construction. The advantages of it are described by Mr Robertson in the following terms: "I have found these hammels or cattle-sheds, much better than any large or open court and yard. Cattle kept in great numbers waste more straw, they fight, and hurt one another with their horns. All this is prevented when they are kept in separate divisions, and above all in these hammels, we can give them what meat we choose, and in what proportion we think proper; and can separate those of different ages, who ought not to be associated together."

Two points on the subject of farm-houses and offices, require, however, some attention. 1. By whom they ought to be erected; and, 2. By whom they ought to be kept in repair.

In regard to the first point, it is certainly desirable, that the landlord, who has a permanent interest in the soil, should, if he can afford it, be at the expence of all substantial improvements *. But how can that be expected in the case of entailed estates, where the proprietor has only a life interest in the property. Frequently,

* Mr Church of Hitchill in Dumfries-shire, observes, that the onstead or buildings, ought to be erected free of expence to the tenant. Many a farmer has undeservedly got the character of a bad one, by exhausting his capital on buildings, so much as to disable him from bestowing it on the cultivation of the soil. Inclosing ought to be done at the expence of the landlord, and the fences reared or maintained at the mutual expence of landlord and tenant. In short, all great permanent improvements on a farm should be executed by the landlord, and in consideration of these, let the tenant pay a higher rent.

also, the tenant has a greater command of ready money than the landlord, and will lay it out with more economy, and to more advantage. In that case it may be most advisable for both parties to arrange a plan, by which the buildings are to be erected by the tenant, the farm being let proportionally, at a lower rent, and he receiving a certain sum for those buildings, if valued to that amount, at the termination of his lease *.

As to repairs, the farm-houses and offices in Scotland, are built in a more substantial manner than those of England; and it is in general the practice in Scotland, that the tenant shall keep the house in repair. It is a great addition to the landlord's income, to be exonerated from so heavy a charge, and in Scotland it is rarely found to be attended with any material loss †.

* Mr Milne of Alvah, near Banff, remarks on the subject of farm-buildings, that few farmers have capital sufficient for a farm of 200 acres, the expence of stocking which, at a moderate computation, costs L. 2000 Sterling; and, if new houses are required, which very often happens, *a great deal more is necessary*. Any allowance the proprietor gives for building, is seldom or ever paid until the end of the lease; the tenant's capital is thereby very much drained, before the fields can receive much benefit. It also often happens, that the outgoing tenant has a considerable claim for houses, and in many instances they are so ruinous, that the farmer can neither trust himself or cattle with any degree of safety, but he must be at a great expence in repairing them. In such cases, the landlord should certainly give every assistance he can afford.

† The case in England is otherwise, and the celebrated Arthur Young remarks, that there is not a more mischievous system, than that of trusting repairs entirely to the tenants: ample experience has proved this. It is much better to charge them with a per-centage on the expence, and with all the carting of materials, and finding beer for all artizans.

3. SIZE AND SHAPE OF FIELDS.

This is a point, which, in so far as regards arable culture, has been brought to a considerable degree of perfection, according to the system of husbandry adopted in the more improved districts of Scotland. Nothing can be more absurd, with a view to the culture of grain, than to have a number of small inclosures, irregularly shaped, surrounded with high hedges and trees; and such a system general perhaps in a flat country, where shelter is unnecessary. Such a plan is peculiarly reprehensible, where horses and cattle are the principal objects of attention, as soiling, (or giving them cut green food in yards or houses), is greatly preferable to pasturage: yet so inveterate is the prejudice for small fields, that though the expence of inclosures has now become enormous, they are still persevered in, even in new inclosures, under the authority of acts of Parliament, by which the charges of that foundation of agricultural improvement are greatly increased, to the injury, and not to the advantage of the property inclosed. We shall proceed, therefore, to state, what in Scotland is considered to be the best size of fields in an improved arable district, and the principles on which the system is founded.

The circumstances on which the size of fields ought to depend, are principally the following:

The expence of repairs varies so exceedingly, according to the age of buildings, their number, and the nature and price of materials, that it is impossible to draw averages: in Suffolk, I should guess from 5 to 15 *per cent.* on the rental of farms above 100 acres.

1. The size of the farm in which they are situated ;
2. The nature of the soil or subsoil ; 3. The rotations adopted ; 4. The number of ploughs in the farm ; 5. The command of water : 6. Access to roads ; 7. The elevation of the ground ; 8. Its being in pasturage or otherwise ; and,
9. The nature of the climate.

1. *Size of the Farm.*—The size of fields ought certainly, in some measure, to depend, on the extent of the possession. In small farms near towns, from six to twelve acres may be sufficient ; but where farms are of a proper size, fields from twenty to even fifty acres, in some cases as high as sixty, is the size that has been recommended, and that in no case, they should be under twenty Scotch or twenty-five English acres, if it can be avoided. One of my correspondents indeed states, that his inclosures are about twenty Scotch, or twenty-five English acres each, and that he would certainly enlarge them, were he not restricted to that size by his lease. Mr Brown of Markle, whose knowledge in every branch of agriculture is so well known, considers a field of thirty Scotch or thirty-eight English acres, to be a proper medium size, when permitted by local circumstances.

2. *The nature of the Soil and Subsoil.*—The best size of fields for arable cultivation, must always depend upon the nature of the soil and subsoil. When the soil is chiefly dry, it is of consequence to have the fields large, as it tends to accelerate the ploughing, harrowing, reaping, &c. ; but when it happens to be strong clay, it then becomes a matter of prudence to contract the size of the fields, chiefly for the purpose of keeping them as dry as

possible*. Mr Rennie of Fantassie, whose farm contains both strong and dry land, divides his clay soil into fields of forty-two Scotch, or fifty-three English acres, and his turnip soil into sixty-two Scotch, or seventy-seven English acres. In turnip soils, the following plan has been recommended by Mr Carnegie of Drylaw-hill, in East Lothian. Where the farm would admit of it, he would divide the whole into eight fields of thirty acres each, under a rotation of, 1. Turnip; 2. Wheat and barley; 3. Grass, and, 4. Oats: and he would have two breaks or divisions in each field, one-half, (or fifteen acres,) of the inclosure in turnips, and the other in grass, and when ready to consume the turnips, he would strip one half of them, and give them to the sheep on the grass: He would then move back the flakes or hurdles, and would allow the remaining half to be consumed on the ground, with liberty to the sheep to pasture over the whole grass while eating the turnips, taking care never to give the stock more than a fortnight's turnips at a time. Thus there would be four fields with white crops, after turnip and grass.—This seems to be a useful hint.

3. *The rotation adopted.*—It is considered to be a proper rule, that whatever is thought to be the rotation the most suitable to the soil, the fields should be neither more nor less than the proper division that the rotation of crops requires, that is to say, a farm with a rotation of eight courses, should be divided into eight fields; six courses into six fields; five courses into five fields, and four courses into four fields or inclosures†. That rule is laid down by Mr Murray, (Kirkland-

* Remarks by Mr Rennie of Kinblethmont.

† The size, it is said, should be equal to the fallow-break.

hill), with a view of having the whole field under one crop at the same time. It is proper, however, to observe, that where the climate is uncertain, and the soil various, the following practice has been adopted, that of having a division of every kind of grain cultivated in the farm in the strong part, and another division in the lighter part. This gives the tenant a fair chance to have an equal crop, whether the seasons are dry or wet, and whether they are favourable to the one species of soil or crop, or to another *.

4. *Stock on the Farm.*—It has also been observed, that the size of the fields should be somewhat in proportion to the number of horses and ploughs on the farm; for instance, where six two-horse ploughs are kept, and where it is difficult, from the nature of the soil, to keep larger fields than from eighteen to twenty-two English acres sufficiently dry, that is a convenient size, as there is less risk of being overtaken by bad weather, and prevented from completing the preparation of the land for the intended crop; for with twelve horses in the spring season, a field of that size can always be finished in four days †.

5. *Water.*—It is necessary in every field actually to be pastured, to have a supply of water, the command of which is more likely to be obtained in large, than in small inclosures. A correspondent, whose fields are

* Remarks of Mr Peter Jack, of Moncur, in the Carse of Gowrie.

† Remarks by Mr Peter Mitchell in Stirlingshire, and Mr James Cuthbertson in East Lothian.

small, complains of their being so ill-watered, that the stock when pastured in some of them, cannot get a supply, even in winter.

6. *Roads*.—It is essential that each field should have convenient access to the farm-road; so obvious a principle need not be dwelt upon.

7. *Elevation of the ground*.—It is also evident, that the size of the field must in some respects depend on the flatness or elevation of the ground. Even on dry land, if there is a rise on the ground, from fifteen to twenty chains is length sufficient; for where the ridge is longer, the horses are too much fatigued if compelled to plough a strong furrow, up-hill, farther in one direction.

8. *Pasturage*.—Where the system of grazing and tillage is alternately followed, (more especially where the fields are pastured for two or three years or more), it is convenient to have the fields about twenty-two Scotch, or twenty-seven English acres; because the farmer generally wishes to have his stock divided, which cannot well be done with larger fields, and if they are of a smaller size, too much ground is occupied with fences. Besides, if grass fields are let for pasture, such a size suits graziers best, and consequently rents considerably higher than larger ones would do. Unless where there are small fields near the house, it is therefore desirable, to have some part of the green-crops near the farm-offices. For if the fields are all large, the whole lot of turnips or clover might be removed to the outward boundary of the farm; whereas if fields are of a moderate size, it is

possible to have a part of these crops at regular distances *.

9. *Climate*.—The last circumstance on which the size of a field ought to depend, is climate. In dry and cold climates, small inclosures are desirable, on account of shelter: whereas, in wet countries, the fields under culture cannot be too open and airy, for the purpose of drying the ground, of bringing forward and ripening the grain, and for enabling the farmer to secure it, during any harvest, however unfavourable.

We shall now proceed to make some observations on the shape of fields, the form of which should be square, and the soil, if possible, uniform.

SQUARE FORM.

It is evident, that it is advantageous to have the fences in straight lines, and that fields when large, should be square, and when small, of an oblong square, so that the ploughing may be dispatched with as few turnings as possible. Some people, whose farms are of a waving or uneven surface, and who inclose with hedge and ditch, carry their ditch through the hollows or best soil, with a view of raising a good hedge; thus, often sacrificing, for the sake of the fence, the form of their field. A straight line, however, is preferable, even though it should be necessary to take some particular pains to en-

* Remarks by Mr Brown, Cononsyth, by Arbroath. Another correspondent observes, that some extent is desirable for fields in pasture, to attend the stock pasturing over its surface; others prefer small fields.

rich the soil for the thorns, when it is thin and poor, on such elevations *. In regard to the square form, an opportunity is thereby afforded, of ploughing in every direction, when necessary, and less time is lost in carrying on all the operations of husbandry in a field of that form, than of any other shape.

UNIFORMITY OF SOIL.

An intelligent farmer laments, that the inclosures on his farm are laid out, more with a view to beauty than utility, and that regularity and uniformity of appearance have been chiefly attended to, whilst little regard has been paid to a point infinitely more essential, that of having the several fields of the same sort of soil; hence soils of the most heterogeneous nature are thus unfortunately comprised in the same field. Another farmer complains, that this principle has been so little attended to on his farm; that he has ridges, one half consisting of a strong wet clay, and the other half of a sandy soil, fit for turnips. A spirited correspondent proposes to obviate this objection, by altering the texture of the soil. He observes, that there are fields, partly consisting of strong soils, and partly of light, where probably there are not above one or two acres of the latter, for ten or twenty of the former; and where almost every year the culmiferous crops fail on the light soils from drought. He therefore suggests, that at any slack time, whether in winter or summer, when the field is under fallow, it would be proper to employ two carts and horses, with four fillers, and to cover the

* Remark by Mr Church, Hitchell, near Annan.

acre or two of light soil, with the strong soil contiguous, which might be all done in one or two days. Draining perhaps would, in the first place, be necessary; but the soil in the field would ever after be uniform. In fields where light soil predominates, the same plan reversed, might be adopted.

We shall now proceed to state the advantages of attending, as much as the circumstances of the case will admit of, to the principles above laid down.

1. Every intelligent farmer will admit, that it is a material drawback to the cultivation of his farm, if the fields, instead of being regular in size or form, are laid out arbitrarily, without attention to any judicious system, and where the whole farm is divided into fields of various sizes, from 5 to 10, and thence to 20 or 30 acres each, it is extremely difficult to equalize them, so as to suit any judicious rotation of crops; whereas by having fields of a proper size, the whole strength of the farm, and the whole attention of the farmer, is directed to one point, and there is also an emulation among the ploughmen, when they are assembled together:

2. It is evident, that where fields are of a proper size, less ground is wasted, there are fewer fences to uphold, and fewer birds to destroy; that the crops of grain can be more early harvested, and are less apt to suffer in dry and clear weather; and that though small inclosures are better sheltered in winter, yet the opener they are in summer the better; for in hot weather the cattle and sheep always go to the airiest places*. But the principal argument in favour of large fields is this, that

* Remarks by Mr Robertson of Almon.

much labour is wasted by short turnings, &c. ; hence an intelligent farmer, (Mr Mitchell of Balquhain,) has well observed, *that if fields were of a regular shape, and the ridges of a proper length, five ploughs will do as much work as six ploughs in fields of a small size, and of an irregular shape ; and every other part of the business to be performed, as dunging, sowing, harrowing, reaping and leading, will be executed nearly in the same proportion.*

Some general remarks on this important point, (the size and shape of fields,) still remain to be stated *.

* On this subject the following hints merit consideration.

In regard to the proper size of inclosures for a farm of 200 acres, I think there should be eight of 20 acres, and four of 10 ; and the best rotation in my opinion is, upon the 20 acre fields, turnips, or a plain fallow, after which any kind of white crop the tenant thinks will pay him most, and to sow along with that crop 8 lb. of white, 6 lb. of red cloverseed, and one bushel of permanent rye-grass seed, to remain in pasture for four years, and when broken up, to take oats ; then to follow the same rotation as at first. The four small inclosures should be made upon the best and strongest part of the farm, and the rotation I would follow, would be a plain fallow, wheat, 12 lb. or 14 lb. of red clover, and two pecks of annual rye-grass *per* acre sown along with it ; then to cut green what is necessary for soiling the work horses, and the remainder made into hay for them in the spring ; then oats, and the same rotation as at first. If this plan of management is followed upon a soil that will improve itself in pasture, I am certain a good crop may always be depended upon, and with little expence.

For a farm of 300 acres, the same number as the one of 200, only larger, that is to say, eight of 30 acres, and the four small inclosures, fifteen acres, and the same rotation followed. For a farm of 700 acres, I would say eight inclosures of 50 acres, and twelve of 25. With those of 50 acres, I would follow the same rotation as what I propose upon the other two farms, and with the twelve inclosures of 25 acres, an eight or

1. Though fields, on the whole, should be of a large size, yet there is a great convenience in having a few smaller fields near the farm-house; for the family cows; for rams, where sheep are kept; for trying on a small scale, useful experiments; and for various other purposes*.

2. Where inclosures are found too large for particular purposes, the field may be effectually subdivided by sheep-flakes, or hurdles, a sort of portable fence, well known to every turnip grower. When carefully set, they have been found a complete fence, both for cattle and sheep. By this means great advantage is derived, from the constant use of the land that would otherwise have been occupied by stationary fences, and the expence of subdivisions, which, on a large farm, would necessarily have been numerous, is thereby avoided†.

4. LENGTH, BREADTH, AND SHAPE OF RIDGES.

The general advantages to be derived from ridges

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four course shift can be adopted; but with the eight-course always to remain four years in grass. This plan of management is only for good soils that will improve by being in pasture, as there are thin clay soils, that the longer they remain in grass, they always get worse, and for which a four-course shift is the best; and the farm should be divided in eight, twelve, sixteen, or twenty inclosures, according to its extent. One or two of the fields could be cut green for soiling the horses, or made hay for them in the spring; but if the tenant chuses, he can take one year's pasture.

* Remarks by Mr Robert Kerr, the intelligent Reporter of Berwickshire; Mr Wilson of Simprin, and others.

† Hints from Mr Hunter of Tynefield, and Mr Cuthbertson near Prestonpans.

have been very ably stated by Lord Kames, in his *Gentleman Farmer*, (Chap. 4. Sect. 3.) It is only necessary, therefore, in this place, to explain those more minute particulars, which have not hitherto been dwelt upon, and which, without the assistance of a number of practical farmers, it would not have been in my power sufficiently to have elucidated.

On very dry soils, ridges are of use merely as lines for marking out the operations of the plough, and the sowing and reaping; the nature of the soil, which is apt to suffer by want of moisture, rendering any sort of draining which the furrows might afford, prejudicial rather than advantageous. Indeed, where grain is sown by drill-machines, ridges are not required even for sowing, as the drill itself, or a marker attached to it, regulates the operation. But ridges are essential in wet soils, operating as open drains, without the assistance of which, the crops would rarely be productive in rainy seasons. It is of infinite importance, therefore, to the farmer, to be fully master of the rules by which ridges can be formed to the best advantage. This subject may be considered under the following heads: 1. The proper length of ridges; 2. Their breadth; 3. Their straightness, and the best mode of altering the shape of crooked ridges; 4. Their height; and, 5. The advantage of ridging diagonally where the ground is steep.

1. The proper Length of Ridges.

The length of a ridge must vary, according to the size of the inclosures, the acclivity of the ground, and the nature of the soil, whether wet or dry.

On fields which have much acclivity, a long ridge is hurtful, not only as tending to fatigue the horses, and to overstrain them in their wind, but also because, after the

ground is ploughed in winter, if much rain or snow falls, the surface of the ridge will be injured, more especially in the furrows, by the long-run and large collection of water, by means of which the finer particles of the soil are washed away, and either carried off the field, or lodged on the headland at the bottom. In such situations, ridges of about 150 yards, are found to be most convenient *.

In regard to wet soils, where the ground is flat, from 240 to 300 yards, is considered to be the proper length : If it should exceed 300 yards, the water might not easily get away ; and if the field is longer, it is necessary to make a head ridge across the hollow of the field, so as to form a level for carrying off the extra moisture †.

In dry soils, and where the land is level, the ridge may be still longer, and indeed some recommend from 700 to 800 yards ; but, on the whole, from 350 to 400 yards seems to be preferable : When it much exceeds the latter size, the horses are apt to be fatigued, and with such a length, as little time is lost in ploughing and turning as could well be desired ‡. Besides, when the ridge is very long, it becomes more difficult to sow, and it has a tendency to discourage the reapers.

* Remarks by Mr Stewart of Hilside, and Mr Charles Alexander of Easterhaprew.

† Indeed, wherever a field contains a hollow, transverse to the direction of the ridges, and more especially in wet soils, or retentive bottoms, a cross head-ridge, or a transverse water-furrow, ought invariably to be made at that place.

‡ Remark by Mr Dudgeon, Prora.—Mr Brodie, Garvald, observes, that a long ridge has fewest interruptions from the

2. *The Breadth of Ridges.*

This is a subject on which there is a great diversity of opinion, in some cases only 4, in others 30 feet, being recommended *. The material objection to narrow ridges is, the great proportion of the ground that is unprofitably occupied by furrows, which are always inferior to the rest of the soil. On the other hand, narrow ridges are of use in draining wet soils. Much, however, depends, 1. On the depth of the soil; and, 2. On its texture or quality.

1. In regard to depth, when the soil is very thin, with a clay or tilly bottom, and the ground very wet, 10 feet ridges are preferred by some farmers, converting them into crown and furrow alternately, by which the best soil is kept near the surface, and never buried: But even in such soils, 18 feet ridges are recommended by high authority †.

turnings, and of course more land will be ploughed in an ordinary yoking, than when the ridges are very short.

* Mr Money Hill, a celebrated Norfolk farmer, is of opinion, that when land cannot be drilled before the 20th of October, it is better to plow in the wheat on four feet ridges. On wet soils, this is advisable, because it keeps the seed dry; and in thin soils, because it increases the staple; for by this system, the soil of five feet is put on four; and from many years experience, Mr Hill is convinced, that the produce is as great, as if the whole land had been under crop.

† The most difficult of all soils to keep dry, (it is remarked by Mr Rennie of Kinblethmont), is a thin wet clay, upon a retentive subsoil; but even upon such soils, 18 feet ridges are found to keep them fully as dry as any other breadth, as it enables the ploughman to round the ridge completely from the crown to the furrow; and it is well ascertained, that one furrow for every 18 feet, is quite sufficient for conduct-

In Roxburghshire, 14 feet ridges are preferred, both for expedition in reaping, and regularity of sowing; and a most respectable farmer in that country states, that when a young man, he was accustomed, for many years, to sow a great part of his own farm, and if there happened to be any wind, (particularly a cheek-wind), neither he, nor any one employed with him, could ever sow a ridge of 18 feet, once going about, so as to give satisfaction; hence he was induced to adopt ridges of 14 feet, to prevent the seed from being unequally laid down. In Roxburghshire, however, they are more apt to be troubled by wind than in the flat districts on the sea-coast.

2. In East Lothian, so justly celebrated for every operation in husbandry, and in other districts skilled in agriculture, as in Angus, &c. eighteen feet is almost universally adopted on soils of a strong or clayey nature.

This breadth is considered to be the most advantageous for preventing wet, and for dunging, sowing, harrowing and reaping. In regard to wet, there is a sufficient wideness to admit of a gentle slope on each side, effected by twice gathering the soil when ploughed, by means of which the surface water soon gets down into the furrow. The dung also can be easily spread over the surface of such a ridge. As to sowing, it may be done by two casts of the seedsman, unless in high winds. A pair of

ing the water to the nearest outlet. Besides, on such soils, a multiplicity of furrows has only the tendency to render the crop less productive, as it is well known to every agriculturist acquainted with them, that on the sides of the furrows, the crop is always scanty, and sometimes not worth cutting down.

well made harrows covers the ridge at a bout ; and three reapers are found a sufficient number to cut the grain, the centre one making ropes for all the three, and none of them having far to go to lay in the corn they cut down : At the same time, where the crop is abundant, it might be advisable to have four reapers, with two rows of sheaves, and two binders to bind for three ridges *. It is evident, that in wet land it would not be advisable to have ridges broader than eighteen feet, as it would then be necessary to gather the ridge thrice in ploughing, for the purpose of laying it dry, by which process, in ordinary soils, the furrows would be rendered so bare, that upon two or three feet of every furrow, the corn would not be worth the cutting †. The only question, then, is this, that though on the east coast of Scotland, where the climate is dry, eighteen feet ridges may be advisable ; yet whether on the west coast, where so much more rain falls, from ten to fifteen feet may [not, on wet soils, be more convenient.

On very dry porous turnip soils, it is of little importance, as has been already observed, whether ridges are formed at all, unless to regulate the sowing and cutting down in harvest ‡. An intelligent farmer in Dumfriesshire, (Mr Church of Hitchill), has his ridges in general 30 feet wide, when the soil is dry § ; and in regard to such soils, no specific standard is necessary.

* Remark by Mr Dudgeon, Prora.

† Remark by Mr Rennie, Kinblethmont.

‡ Remark by Mr Hunter of Tynefield.

§ That respectable farmer, Mr Money Hill, has favoured me with the following observations on this subject. On tur-

3. *Straightness of Ridge.*

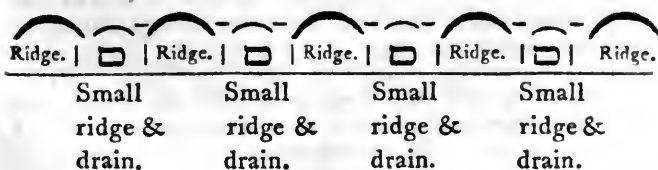
It is extremely material to have the ridge as straight as possible. It is calculated that ridges, when much crooked, measure one-fourth more in the serpentine direction, than when taken in a straight line *, and consequently they must take one-fourth more labour in ploughing, harrowing, &c. than if they had been perfectly straight. Most of the ridges in the more cultivated parts of Scotland, were formerly very broad, much raised, and greatly curved. Levelling high and crooked ridges, in very stiff wet clays, is a very difficult operation, and unless executed with considerable skill and judgment, productive of loss. The risk attending such an alteration, induced a spirited practical farmer, (Mr James Andrew of Tillylumb, near Perth), to try

nip soils he remarks, that ridges twelve paces wide are the most proper. A ridge of this width can be ploughed much sooner than two ridges six paces wide. A ridge twenty-four paces wide cannot be ploughed so soon by an hour as two ridges twelve paces wide. The cause is evident; in the narrow ridge above-mentioned much loss of time is experienced at the end of the field, in turning the horses about nearly to the same place from whence the plough left its work. In the larger one, much loss of time is also experienced at each end of the field, from the plough having to move so many yards out of its work before it arrives at its proper situation for re-entering again the land. Whilst little or no loss of time is experienced in the plough and horses swinging about to enter their work again, in a ridge twelve paces wide. In sowing broad-cast, six paces wide, being the usual breadth, a seedsman covers at a cast: the top of the ridge and the furrow are the leading marks which directs him to deposit his seed.

* Remark by Mr Charles Alexander of Easterhaprew, near Peebles.

a new plan, which as it has answered the object he had in view, it is necessary to explain, and which may be applied indeed to wet soils in general, whether the ridges are straight or crooked.

Mr Andrew states, that the ridges on his farm had formerly been broad, and much raised*. His predecessor had levelled them by the plough, and when he entered into the farm, almost all the good earth had been thrown into the old furrows, and completely drowned, the crowns of the old ridges were at the same time so much stripped of soil, that they were scarcely fit to carry any thing. It was absolutely necessary, however, to do something to bring the ground into a better state. As it lay on a gentle slope, cross draining was attempted, but ineffectually. He had then resolved to gather up the ground to the old ridges, by as many ploughings as might be necessary to raise them nearly to their former height, and *to throw a drain into every furrow*, thus designing, by one operation, to dry the ground, to equalize the soil, and to give it a fallow. When these operations were completed, he gathered up a small ridge into the furrows above the drains, to protect them from the surface water. The following sketch will give some idea of the nature of this operation :



* There is reason to believe, that when waste lands are first brought into a state of cultivation, the ridges should be very broad and high until the soil is condensed, for at first it is generally of a soft and spongy nature.

The drains are generally two feet and a half deep, and as narrow in the bottom as an ordinary spade can conveniently work them. He always thought it necessary to go down until a solid tilly bottom was found, in order that the water might always run immediately above the till. The drain was filled to the depth of a foot, or rather better, with small stones, the undermost being always carefully laid in by the hand, and the rest thrown in promiscuously above them. The stones were then covered with a little straw, and earth above all. The expence, on an average, cannot be calculated at less than from L. 8 to L. 10 an acre; but the outlay will be amply repaid, for every object Mr Andrew had in view will be accomplished. In its former state, the ground could only be ploughed at certain times. The farmer was at the mercy of every season, and found none so dry, that in a certain degree he did not suffer some injury; *but now, he can plough almost at any time, the seed can be put in if there is but a dry day, and in the ordinary course of things, he can always rely upon a crop, and the soil being equalized, the crop is always equal.* Mr Andrew expresses his regret, at seeing the mischief that has been done, almost in every corner of Scotland, by the attempts which have been made to level high ridges by the plough; and I certainly think, that before any proprietor or tenant resolves to carry any plan of that sort into effect, he ought to examine the result of the measures which have been adopted on the farm of Tillylumb.

4. Height.

It is highly necessary that ridges, on wet land, should be well rounded, so as to form the segment of a circle. This is effected by gathering the soil once or twice, according to its dryness or wetness, in the course of plough-

ing the ridge. The height, however, should not be too great, only sufficient to furnish a declivity to let off the water; for when the crown is raised too high, one-half of the ridge is always covered from the sun, (a disadvantage which is far from being slight in a cold climate), and the crop, which is always best on the crown, is more easily shaken by the wind, than where the whole crop is of an equal height *. Nothing can be more absurd than an idea entertained by some speculative agriculturists, that the higher the ridge is raised, the more surface must be obtained, and consequently the greater crop. Some planters had a notion that more trees could be planted on a hill than on a plain of the same extent, which is now given up as ridiculous. In regard to arable culture, it can hardly be questioned, that the more the equality of soil, (which cannot happen where the ridges are high raised), the more equal will be the crop, and the more abundant will be the produce †.

5. *Line of Direction.*

The last point regarding ridges, which it is necessary to consider, is the line of direction, more especially in steep grounds. In such situations, it has been found a great advantage, both for the facility of ploughing and for draining, to plough diagonally from left to right: the furrow going up the hill falls off from the plough, the horse has better footing, and less pull, and the furrow catches the running springs ‡. This is particularly to be

* See Gentleman Farmer, p. 74.

† Remark by Mr Charles Alexander, Easterhaprew.

‡ Remarks by Mr Stewart of Hillhead.

attended to in the case of drilled turnips; for owing to the many furrows between the drills, when the turnips are eaten off by sheep, not only the soil, but their dung and urine, are carried off, which greatly augments the evil. Besides, where the field is steep, the dung can be much easier carted on diagonal ridges*.

Another rule regarding this point is, to direct the ridges north and south, if the ground will permit. In this direction, the east and west sides of a ridge, dividing the sun equally between them, will ripen at the same time †.

5.—OF PLOUGHING, AND THE MOST ADVANTAGEOUS PRINCIPLES OF CONDUCTING THAT OPERATION.

The plough now commonly used in Scotland, from the simplicity and the excellence of its construction, is perhaps the most useful instrument ever invented. It is cheap, is applicable to all soils and situations, can be worked by two horses or oxen without a driver, and is calculated either for deep or shallow ploughing, as the case may demand. It requires more skill in the management than wheeled ploughs, which the farmer may set to any particular depth, and which the ploughman cannot vary from at pleasure; but the dexterity which the Scotch ploughmen attain by practice, cannot be surpassed, and such a check is therefore unnecessary. Bad ploughmen, at the same time, may certainly be met with in Scotland, as well as in other countries, but not so fre-

* Remark by Mr Charles Alexander.

† Gentleman Farmer, p. 79.

quently. To this perfection, the premiums given to the best ploughmen, at annual competitions in various districts of the country, have greatly contributed.

The importance of good ploughing is such, that an intelligent farmer remarks, he has often observed a difference in the crop of some ridges where he has had a bad ploughman.

The great difficulty in ploughing is, to determine the width and depth of the furrow slice, which must vary according to the object the farmer has in view, and the preceding and succeeding crop, &c. The following table will give some idea of what is considered to be a proper size, in different circumstances.

TABLE OF PLOUGHING.

<i>Nature of the Ploughing.</i>	<i>Width Inches.</i>	<i>Depth Inches.</i>
First fallow furrow, - - -	10	6 8 10
Second furrow, ditto, - - -	9	6 7
Seed furrow, - - - -	7	4
Oat crop from turnips, - - -	9	6 7
Oat crop from clover ley, - -	9	4
Beans, if on one furrow, - -	10	6 8
Beans, if a second ploughing, -	9	5
Beans, seed furrow, - - -	9	3
Barley, - - - - -	8	4
Potatoes, - - - - -	9	3

The depth of ploughing must, in a great measure, be regulated by the soil there is to work upon. On thin soils, more especially on a rocky substratum, the ploughing must necessarily be shallow; but where the soil is of a depth sufficient, it is material to plough deep at the com-

mencement of a rotation, and afterwards to vary the depth, according to the different crops intended to be raised.

Fallow, however, ought not to be deep ploughed, until it is cleared of every description of root-weeds: It may then get a good deep ploughing, so as to bring to the surface, land that has been lying in a dormant state for years; and by afterwards ploughing alternately deep and shallow for the succeeding crops, you will be enabled to change the surface, and bring up new soil for each crop.

It is said, that when the soil is incumbent on sand, till, or gravel, it is much better to rest contented with the depth of soil you already have, than attempt to increase it, at the hazard of bringing up such unproductive articles. But such an idea is condemned by many intelligent practical farmers. It is observed by them, that though deep ploughing, without manure, or frequent exposure after it is brought up, may be unprofitable, (as the subsoil is less productive in its natural state than the surface), yet where these are properly applied, the soil, its thickness being increased, becomes more impervious to wet, and less so to drought, and of course more fertile; nor where the land is shallow, is the turning up of a little till to be apprehended, if the till is not of a poisonous quality; as by that means you deepen the soil, which, when mixed with lime and dung, will be found a great improvement*.

* Baron Hepburn says, that though deep ploughing shall bring to the surface a sour looking obdurate pale yellow coloured till, I care not, *experto crede*, the manure given to the fallow mellow it sufficiently.

The following general rules regarding the depth of ploughing, have been recommended from various respectable quarters, and as the subject is of infinite importance, it cannot well be too much inculcated, nor represented in too many points of view.

Maxims as to deep Ploughing:

1. The depth which land ought to be ploughed, ought to be regulated by the depth of soil, and the means of improving it; when the soil is deep, whether light or clay, it ought to be ploughed as deep as a pair of horses can go, and at some seasons perhaps it might be advantageous to plough it with four horses; but where the land is thin and poor, and the means of enriching it scanty, I should recommend the depth of ploughing to be in proportion to the quantity of manure.—[Mr Rennie, Fantassie.]
2. Deep ploughing is highly advantageous upon every soil, and for all crops, except on those soils where the substratum is of an ochry sand, which soils, in fact, are scarce worthy of being cultivated, unless in situations, where much alluvial compost, or short town manure, can be procured.—[Mr Brown, Markle.]
3. It is a general rule never to plough so deep as to go through the soil, excepting upon fallow, and that only when you have plenty of lime or dung to add to the new soil.—[Mr Murray, Kirklandhill.]
4. Deep ploughing is certainly liable to this objection, that it requires more manure to enrich a greater body of cultivated soil, than it would do to enrich a lesser; yet land when ploughed shallow, is more easily accessible to drought, as the larger the quantity of wrought land, the longer must the moisture be retained.—
5. Farmers who follow the practice of deep ploughing, find a great advantage from it, both in dry and

in wet seasons. The extreme of either is not so prejudicial as if the crop had been ploughed with a shallow furrow:

6. Many farmers recommend, when fallowing land, to go as deep as possible the first furrow, by which the subsequent furrows will be more easily done, and to expose the soil to the winter's frost and to the summer's heat; but when land is ploughed in spring for beans or oats, a strong soil cannot be ploughed with safety, above five or six inches, and when lime or dung has been mixed with the soil, a shallow furrow, not exceeding four or five inches in depth, is advisable. 7. Deep ploughing is not to be recommended; 1. When rich leys are broken up for cropping; 2. When grass only two or three years old is broken up, more especially where it has been pastured with sheep; for all the richness of the land should be preserved at the top: 3. When lime or other manures have been recently applied, and lime in particular, as it has a tendency to sink of its own accord: 4. Where turnips have been eaten off by sheep on the land where they grew. In all these cases, from four to five inches deep, will be found sufficient; and, 5. If land is infested with grass, which generally runs much on the surface, the first ploughing should not be deep. 8. In the following cases, deep ploughing is advisable. 1. Where the first furrow is given to land intended to be fallowed in the end of autumn or beginning of winter, and where grass or root-weeds do not abound, the soil is thus pulverized and sweetened by the frost; and, 2. In moorish or cold soils, as it affords a greater scope for the roots of plants to procure nourishment, admits the superabundant moisture to subside from their roots, and prevents the summer drought making an injurious impression on the growing crops: For it may be remarked, that on such land, shallow ploughing exposes vegetation

to be starved or drowned in wet weather, and to be scorched or withered in dry.

We shall now proceed to give a general view of the advantages of deep ploughing, a practice which cannot be too frequently recommended.

ADVANTAGES OF DEEP PLOUGHING.

1. Bringing up of new mould is peculiarly favourable to clover, turnips, and potatoes; and indeed, without that advantage, these crops must diminish in quantity, quality, and value.
2. Deep ploughing is of infinite consequence, not only by furnishing more pasture to the roots of the plants, but above all, by preventing the injurious consequences of either too wet or too dry a season. If the season is wet, there is a greater depth of soil for absorbing the moisture, so that the plants are not likely to have their roots immersed in water; and in a dry season, it is still more useful, for in the lower part of the cultivated soil, there is a reservoir of moisture, which is brought up to the roots of the plants by the evaporation which the heat of the sun occasions.
3. By deep ploughing, also, the ground may be more effectually cleared of roots and weeds of every description: at the same time, where they abound, it is a good rule, not to bury them by the first ploughing, otherwise it becomes difficult afterwards to clean the land: But after the land is cleaned, it is then proper to raise fresh mould, to incorporate with the manure to be afterwards applied.
4. An intelligent farmer, after pointing out that deep ploughing increases the staple of the soil, keeps the roots of the corn from being injured by wetness, and also enables the crop longer to resist drought, adds: "*I how-*

*“ ever found deep ploughing attended with good crops,
 “ when ridges, shallow ploughed, in the same field, were
 “ but indifferent. A decisive proof in favour of deep
 “ ploughing *.”*

* The Norfolk farmers, generally possessing a thin light soil, with a poor and barren subsoil, prefer shallow ploughing at all times, and argue that it is easier to keep a small quantity of soil in good heart, than a greater quantity, which would be formed by deep ploughing, and also that it is easier to keep it clean of root-weeds. Mr Church has heard the farmers in that county say, that the land was always injured when the *pan*, or surface of the subsoil, was broken by deep ploughing, which was never done but by a careless, or bad ploughman. There may be some ground for their partiality in favour of their mode of ploughing thin and light soils; and it would not be advisable for them to alter their system, unless they fallowed their lands, gradually deepened them, and limed and dunged the new soil. But if on these principles they were to increase the surface of their soil, their crops would be more certain and abundant, more especially in dry seasons. The following valuable hints on this subject, is drawn up by one of the most intelligent farmers in Scotland, whose name, if he had permitted me to use it, would have done credit to any publication.

“ After shallow ploughing, the crop, in heavy rains, is very apt to be socked about the roots, in consequence of which the straw is whitened prematurely, and the grain does not come to perfection; hence the necessity, when the surface is thin, of thickening it by deep ploughing. I have seen deep ploughing this kind of land, for the first, and even the second year, after ploughing up the under-soil, produce a teasing crop of thistles, which was hurtful to the corn crop; but after the cold soil is well mixed with the old surface soil, and after the lime and dung applied to it, *when summer-fallowed*, has begun to operate on the new soil, I have found great benefit from this operation; but it is the winter-furrow before the summer fallow that should be ploughed deep; the lime and dung applied to the fallow, as I have already mentioned, operate strongly on the fresh soil. I would recommend ploughing even light lands, although thin, to a proper depth, though gravel, stones, or dead sand, is turned up and mixed with the surface soil. I have found no inconveniency by

But although deep ploughing, to a certain extent, is advisable, yet there is a medium in this as well as in other things, and ploughing *too deep*, has not been found to answer. Mr Hope of Fenton, an intelligent farmer in East Lothian, states, that he repeatedly tried the experiment of ploughing very deep with four horses, and that the result was far from encouraging a continuance of the practice. In one case, where he ploughed part of a field of fallow with four horses, at fourteen inches deep, the crop of wheat was evidently worse than upon the rest of the field, that was ploughed in the usual manner; the land at the same time was of good quality, sufficient to have admitted a furrow much deeper than what was given. The reason of the inferiority of the crop upon the deep ploughed part, appeared to be, in consequence of that part of the soil, which had for ages been regularly manured, being turned down below the reach of the roots of the plants, and soil of a poorer quality brought up in its place. He is therefore inclined to think, that it is unnecessary to plough deeper, than where there is a fair probability of the different kinds of plants sending their roots; and as beans, clover, and turnips, the only tap-rooted kinds usually cultivated in this

it. Both turnips and corn crops, as well as pasture grass, stand out better, both in wet and dry seasons, when a shallow surface soil is deepened, even by an under-stratum that may appear very worthless. As proof of the utility of deepening surface soils, both wet and dry bottoms, look at the patches of gardens that have received deep digging or shallow trenching; belonging to the cottages placed on the skirts of the muirs all over Scotland, and you will observe the additional verdure and luxuriance of crop upon these patches, more than upon the lands adjoining, the surface of which is often very little more than scratched by the plough, and the dung and other manure applied to it, has not deepness of soil to operate upon, so as to produce a good crop."

country, seldom send their shoots above seven or eight inches down into the soil, and the culmiferous species not so far, it is probable, from these circumstances, that from seven to nine inches may be deep enough for all the purposes of ordinary culture. Occasionally, however, ploughing deeper, in the course of a rotation, for the reasons formerly assigned, is certainly advisable.

The following points remain to be touched upon, regarding ploughing. 1. The angle at which the furrow slice should be laid in particular cases: 2. The best mode of ploughing steep lands: 3. The advantages of water furrowing; and, 4. The rate of ploughing with a pair of horses.

1. As one principal object in ploughing is, to lay the land so that the harrows may, in the most effectual manner, raise mould to cover the seed, this object is most effectually accomplished by ploughing land of every description, with a furrow-slice about seven inches deep, and which, if about $10\frac{1}{2}$ inches broad, raises the furrow-slice with a proper shoulder; thus endeavouring to form, by the shoulder of each furrow, the angle 45, the point which ought to be referred to, when determining between the merits of different specimens of ploughing. That is best obtained, by allowing the plough to incline a little upon the left side, and making the breadth of the furrow always bear a due proportion to its depth, which is about two-thirds, or as six deep and nine broad*.

2. When a field is exceedingly steep, some farmers plough only down hill, the plough being drawn up hill empty. By this method the horses travel up hill in less than half the time they could go with a furrow, and by being quite fresh at the top, they come down with spirit; and by giving the direction a little to

* Remarks by Mr Hope of Fenton.

the left as you go down, the furrow falls away from the plough freely, every inch of the soil is perfectly raised, and lies so close together, that lying in that state for one year in some soils, and in others for two years, the sod rots, and being all laid one way, cuts easily by the plough; whereas, when attempting to plough against hill, the ploughing is not half done, grows up in grass, and, when cross ploughed, makes a bad appearance; and the fighting against hill, hurts a horse, in one day, more than three days' ploughing in the way pointed out. Only one-fourth of the time is lost, but that is doubly repaid, by getting the work properly done, and the advantage in the after ploughing. Mr Blackie of Holydown, in Roxburghshire, who makes this remark, states, that he has cultivated a great deal of ground on this principle, and that he is never afraid of any land, however steep, if there is soil enough; and that by this mode land may be ploughed, which would otherwise be impracticable. In similar situations other judicious husbandmen prefer ploughing in diagonal ridges, so constructed as to admit of ploughing up hill without material injury to the horses; and in this way the furrows are much less apt to be run away or sanded by heavy rains. Where the land is excessively steep, it is often necessary to plough directly across, throwing the plaits or furrow-slices all down hill; and, with the ordinary plough, going back empty. But where there is much land of this excessive steepness to cultivate, a plough with a shifting mould-board, usually called a *turn-wrest* plough, admits of ploughing both backwards and forwards, shifting the mould board in such a manner as always to throw the furrow-slice down hill. These two last methods have been suggested by Mr Kerr of Ayton, in his Berwickshire Report, who has seen and practised both.

3. In preparing land for a crop, water-furrowing is a very important operation, more especially in wet soils and climates ; indeed not only are these water-furrows, or surface-drains made and dressed by the plough, but a *spade-man*, is also employed, to clear them out, as soon as the ridge is ploughed : the land is thus never injured by surface-water *.

4. An intelligent farmer, (Mr Blackie of Holydown), has sent me the following statement of the number of miles his ploughs travel in a day. An acre of land, he observes, is ten chains long, and one broad ; one chain is 66 feet : divide that into 80 furrows, which is as narrow as any body ploughs,—the whole furrows in one acre measure no more than eight miles. An acre in one day is very good work for two horses, yet is a very slow pace when divided into eight hours work, one mile *per* hour. Turning at the ends of the land takes up one-tenth of the time. In dry fine soil, and level ground, a pair of good horses will plough twelve chains ; on wet heavy land, nine, sometimes not more than eight chains ; in crossing or stirring turnip land in summer or spring they will do sixteen chains, and in some very fine free land two acres.

Mr Erskine of Mar, who has paid much successful attention to many branches of husbandry, calculates, that the number of yards travelled in ploughing an acre and a half with a sixteen inch furrow slice, is 16,320 yds. And with a furrow-slice of 18 inches, - 14,400
The furrow-slice of 8 inches, - - 32,640
————— 9 ——— - - 29,040

To the same intelligent correspondent, I am also indebted for the following tables.

* Hints from Mr Peter Jack, of Moncur. This plan is adopted, not only in the Carse of Gowrie, but in all the best cultivated districts in Scotland.

Tables shewing the Quantity of Ground ploughed, according to the different Breadths of the Furrow-slices, and the rates of the Horses walking.

Breadth of the Furrow-slice.		Rate per Hour.		Length of Way travelled in ploughing.	Quantity of Ground ploughed.		Breadth of the Furrow-slice.		Rate per Hour.		Length of Way travelled in ploughing.	Quantity of Ground ploughed.	
In.	Miles.	Furlongs.	Yards.		Roods.	Poles.	In.	Miles.	Furlongs.	Yards.		Roods.	Poles.
8	1	—	14,144		2	24	8	2	—	28,168		5	7
9	—	—	14,157		2	37	9	—	—	28,193		5	33
10	—	—	14,148		3	11	10	—	—	28,188		6	21
11	—	—	14,157		3	22	11	—	—	28,215		7	5

The Rate of walking being 1 Mile and half a Furlong.

The Rate of walking being 3 Miles.

8	1	$\frac{1}{2}$	14,960	2	30	8	—	—	42,296	7	31
9	—	—	15,004	3	4	9	—	—	42,350	1	30
10	—	—	15,012	3	19	10	—	—	42,336	9	32
11	—	—	15,048	3	32	11	—	—	42,273	10	27

The Rate of walking being 1 Mile 4 Furlongs.

The Rate of walking being 4 Miles.

8	1	$\frac{1}{4}$	21,216	3	36	8	4	—	56,336	10	14
9	—	—	21,120	4	14	9	—	—	56,386	11	26
10	—	—	11,168	4	35	10	—	—	56,376	13	2
11	—	—	21,186	5	14	11	—	—	56,430	14	10 *

* It is supposed that in England in general, the common breadth of the furrow-slice, is about nine inches; but from the shallow ploughing which the generality of the farmers in Norfolk, for various reasons, prefer, their furrow-slices are full eleven inches broad; so that the quantity of the ground stirred in the same number of hours work by them, must be considerably more than farmers in other districts can do, where the nature of the soil requires to have the furrow-slice of a narrower breadth.

It may be proper also to observe, that some farmers, convinced of the advantages of frequent ploughing, keep an extra stock for that purpose. Mr Andrew of Tillilumb, states, that he has always had four pair of work-horses, and generally in spring and autumn he has been in the custom of making up a fifth pair for harrowing, by yoking a saddle-horse and young colt. This is rather more than is usually kept on farms of such an extent, (112 Scotch acres), but he has an advantage by it, as he is thus able to dress his land the more completely. For potatoes, he gives four ploughings, and sometimes five; for beans and barley, always three; for wheat after oats or beans, three; which he finds effectually secures it against the depredations of the slug-snail.

Here it may not be improper to take notice of a practice, which was known in Scotland many years ago, that of spring sowing, without spring ploughing, and which is still occasionally adopted. Lord Kames, in his *Gentleman Farmer*, first printed *anno* 1776, has strongly recommended it, even though the scarificator or scuffler was then unknown*. Mr Fletcher of Balinshaw, in Forfarshire, was accustomed to sow barley on a winter furrow, above twenty years ago. A respectable farmer in

* The preferable method for sowing oats, and especially in a clay soil, is to turn the field over after harvest, and to lay it open to the influences of frost and air, which lessens the tenacity of clay, and reduces it to a fine mould. The surface soil by this means is finely mellowed for the reception of the seed; *which it would be a pity to bury by a second ploughing before sowing*. We are taught by experience, that this soil ploughed before winter, is sooner dry than when the ploughing is delayed till spring; and as early sowing is a great advantage, any objection on account of the superficial crusting is easily removed by a strong harrow, which would produce abundance of mould for covering the seed. Kames's *Gentleman Farmer*, p. 95. and 96.

the Mearns observes, that if too great an accumulation of work was likely to be apprehended in the early summer months, an additional ploughing might be saved, by sowing oats on the winter furrow; and another intelligent farmer near Dalkeith, (Mr Mylne of Smeaton,) remarks, *that ploughing for barley in spring is unnecessary, unless in a very bad season, when the land could not be wrought, as it should have been, before winter.* Mr Yeaman of Murie, near Dundee, also tried barley on a winter furrow; and it was observed, on the crowns of the ridges, and as low down as the middle, between that and the furrows on each side, the barley was more luxuriant, and appeared richer than that sown in the common way; but towards the furrows, it was thinner and shorter, so that on the whole the difference of produce would not be material. A ploughing, however, was saved.

On a point not yet finally settled, it is proper to state the arguments on both sides, leaving the question to be ultimately decided by future experiments. The farmers in the Carse of Gowrie do not think it would answer their strong soil. When they have spare time in the beginning of winter, to plough part of their clover leys before Christmas, (which is sometimes the case), they think the mould or soil is too close, and on that account the oats is a more stunted crop, than when the ley is ploughed in January or February. The early ploughed land is also more apt to carry couch grass among the oats*. Mr Paterson of Castle-Huntly is decidedly of the same opinion. He admits, that barley might be sown on the winter furrow, where the soil is loamy, with a better chance of success, for that particular crop; but the repeated ploughings, both in clay and loam, during the driest sea-

* Remarks by Mr Jack of Moncur.

son of the year, before the barley seed-time, is so necessary for perfectly cleaning the land, that no saving of labour could compensate the want of them, which saving of labour, *is supposed to be the best, if not the only reason, that can be given, for sowing barley on a winter furrow.* As to the absurdity of burying that part of the surface after being prepared and meliorated by the influence of a winter atmosphere, and bringing up a soil less prepared, he asks, may not this be rather more speculative than solid? He is much inclined to think, that it would be much better to give the land another ploughing, as it would mix and soften the soils, render them more capable of receiving and covering the seeds, and enable them to spread their roots to greater advantage, by which a more certain crop would be insured. Upon the whole, he is clearly of opinion, that it would be impossible to keep the ground clean, and in such good order for a succession of crops, without sowing barley, or something of the same kind, after having gone through all these operations.

On the other hand, it is contended by a number of intelligent English farmers, that spring crops may be successfully sown without spring ploughing. That the land can be effectually cleaned from root weeds by a couch-rake, and may be sufficiently stirred and pulverized by the cultivator or scuffler.

On strong land in Suffolk, indeed, after scarifying merely, they sow barley, or oats, after fallow, or beans, or pease, or tares, or after what is called a bastard fallow. In all these cases, the tillage is given in autumn, and the crops are put in so early, that they are infinitely cleaner than if a spring ploughing were given them, which would have prolonged the sowing for six weeks or two months later.

For beans, this practice has been found peculiarly excellent, and has been attended with such success, that it

has spread from Sussex into Essex, where they have not hitherto tried it much with barley and oats. In regard to oats, however, this plan has been found to answer uncommonly well in the strong lands at Petworth, in Sussex.

6.—ON FALLOWING.

Fallowing, when first introduced into Scotland, was undoubtedly one of the greatest sources of improvement that could possibly have been suggested; for the ground in cultivation, having been kept in constant tillage for ages, was infested with weeds of various descriptions, which by no other means could have been kept down or eradicated. In dry soils, since the introduction of the turnip husbandry, fallowing has no longer become necessary *; but in strong lands, it is still accounted the foundation of their fertility, by numbers of the most intelligent practical farmers that Scotland boasts of.

* A farmer in Angus, (Mr Brown of Cononsyth,) recommends fallows even in dry soils. He states, in a communication to the author, that one-seventh of the dry land of his farm is in fallow or turnips, but in general he only sows about ten acres of it turnips, as he finds that he has much better grass, when sown among wheat after fallow, than with oats after turnips; and when broke up from lea, the difference of the oat crop, in favour of bare fallow, is also discernible. A crop of wheat is obtained at less expence than turnips and oats, and on an average of years, is as valuable: the manure produced by wheat straw may not be so rich as when many turnips are raised, but a greater quantity is procured, and if driven out into a large dunghil in the winter months, will answer perfectly well for fallows.

In considering this subject, it is proposed to give, 1. A general view of the advantages of fallowing: 2. A description of the manner in which it is performed: and, 3. An account of some cases, where fallowing strong lands is not adopted in Scotland. Whether that practice ought to be still more extended in that part of the united kingdom, will be considered, when the further improvements, of which the agriculture of Scotland is capable, comes to be discussed.

1. Advantages of fallowing in strong Lands.

The benefits resulting from this operation are very ably stated by one of my East-Lothian correspondents, (Mr Hunter of Tynefield.) He has always found, he observes, a naked fallow necessary, once during a rotation of six: (1. Fallow. 2. Wheat. 3. Clover. 4. Oats. 5. Beans. 6. Wheat;) and he is persuaded, that it will be found the case, in every soil not of the turnip sort. Clay soils become hard when constantly cropped, by being always ploughed in winter, or early in spring, being often wet during the operation of ploughing and harrowing, and thereby lose their fertility, becoming as it were impervious to the sun and air, as well as to the root of plants, &c. Summer ploughing is necessary to rectify this; besides giving opportunity to take out all sorts of root weeds, to put in lime, &c. &c. and generally pays well for the summer's labour during the rotation. Other drilled crops, as beans, pease, or tares, must be sown early in spring. Potatoes also must be planted in April to have a full crop, and cannot be substituted for a fallow to any tolerable extent; even the ruta бага seems to Mr Hunter unfit for the purpose in our northern situations, as it is long of coming to its growth, and ought to be sown early in May, otherwise it will seldom be a full crop. The grand

object with the skilful agriculturist will be, to keep the land clear of weeds of all sorts, and summer fallow has ever been found the only sure method of doing so. Hitherto no plant has been found so well fitted to permit that as the field turnip, which may be drilled, with the best prospect of success, from the first week of June, to the second week of July inclusive, giving full time to prepare the land, which, together with the ploughings in the rows among the turnips, completes the fallow in the most perfect manner.

This states the question fairly, and if any plant could be pointed out, that would answer as well on strong land, as turnips does on light land, fallowing, in so far as regards the extirpation of weeds, would, with a drilled crop, be as little necessary in the one case as in the other*.

In the Carse of Gowrie also, fallowing is considered to be indispensable. That operation, it is said, by the frequent winter and summer ploughings and harrowings, meliorates the ground, makes it of a kindly texture, cleans it of weeds, &c, enables it to receive the manure in a proper dry season, and allows time for all the small

* Perhaps the newly imported plant called *noll-koll*, may answer the purpose. Mr Buist, overseer to Lord Haddington at Tynninghame, is of opinion, that it may answer on strong soils, in place of a turnip crop. It rises like a cabbage plant till it is about three inches high, then forms like a Swedish turnip, and appears to be much of the nature of that useful plant. They were first raised in East Lothian by Mr Alexander Johnston, surgeon in Dunbar, who some years ago received a few seeds from General Sir David Baird, on his return from the Cape of Good Hope. I saw them in great perfection at Lord Lauderdale's, near Dunbar.

drains to be repaired. The land is thus ready to receive the seed at a proper period ; by which means the successive crops are greatly encouraged, (the ground being in complete order to yield its produce), and less dung answers the same purpose for a succession of crops *.

Nor is this all. Another most intelligent correspondent, (Mr Wood of Millrig), states in the most decided terms, that naked fallow has paid him much better than drilled crops, from their after consequences, as the broad leafed clover succeeds so well after summer-fallow, which it never can do after the bean or the turnip, for their roots take away the nourishment of the earth where the clover-root is fed. The bean or pea also, are great encouragers of the white snail, a determined enemy to red clover. The root of clover, being of the carrot substance, is a great enricher of the earth, and the grass of it produces more feed than any other usually sown. Luxuriant crops of oats likewise, always follow red clover †.

* Hints by Mr Drummond of Westbank.

† Mr Wood, in another communication, enforces the same doctrine. He remarks, that Mr Young, in his Survey of Oxfordshire, is very decidedly of opinion, that clovers will not continue to thrive well in the fourth or fifth course of agriculture. But Mr Wood can freely declare, from many years experience, that there is little or no danger of clover succeeding every fourth or fifth year. provided a complete summer-fallow intervenes betwixt the clovers ; but if green crops are to serve as a substitute for a fallow, he has found in that case, in the same field, the clovers give way, when they succeeded on the fallow part of the ground, the green crop roots taking away that nourishment which is necessary for the support of the clover plant and perhaps, being of a green nature, that may have some effect. He could clearly see it is the farmer's interest to make some imaginary sacrifice to insure red clover, as it can easily be reduced into calculation, that it is the best crop, when pastured judiciously, for nourishing the earth, the roots being upon an acre more weighty than the weight of beef or

Besides these advantages, fallowing is supposed to contribute materially to the destruction of snails and other vermin in the ground, not only by destroying them and their eggs, but also by exposing them to the attacks of rooks and other birds *.

2. Of the manner in which fallowing is performed.

As the most intelligent farmers in Scotland are convinced, that their after crops are good, in proportion to the correctness with which the summer fallowing process is executed, they bestow the greatest possible attention on that operation, by having it done as early in the summer as possible; perhaps by the end of June, completely reduced by repeated ploughings and harrowings. By that time, every kind of root weeds and quickens ought to be gathered off at farthest by the end of July, it should be dunged and seed furrowed by the end of August; of course, ready to sow any time after the 20th September. It has been found that, by allowing land to

mutton fed from it, consequently it is great gain, when the roots make up for what is taken from the surface.

Here it is to be observed, that it is probable the new earth is turned up in the operation of fallowing, which renders the clover plant so successful.

* Mr Money Hill remarks, that fallowing also is indispensable, if a farm has got into bad order. When a farmer enters upon an occupation which has been left by a sloven, on a lease of twenty-one years, it is necessary to fallow all his land as it comes in rotation for wheat, under the fifth and the sixth course system of Norfolk. This will take him eleven years to get the whole farm clean. This grand desideratum being accomplished, Mr Hill considers fallows are unnecessary during the remaining ten years of his lease.

lie for several weeks between seed-furrowing and sowing, it gets consolidated before the roots of the plant strike in the ground, and the plants are not so apt to be thrown out of the soil by the spring frosts *.

It is evident, that this process is attended with considerable expence. Carse and other strong lands, when properly fallowed, require six ploughings, harrowings, &c., which cannot be stated at less than 9 s. *per* English acre each time, or L. 2, 14 s. *per* acre†. It is to be observed also, that more advantage is to be expected from fallowing, conducted on scientific principles, than when it is managed in the careless and slovenly manner which is too often to be seen, where agriculture is but imperfectly understood.

3. *Cases where fallowing strong Lands is not thought advisable.*

Near towns, where manure abounds, the fallowing process is avoided as much as possible. In the neighbourhood of Glasgow, where the rents are from L. 6 to L. 7 *per* Scotch acre, several thousand acres of land, even of a clayey quality, are cultivated under the fallowing rotation, namely, 1. Potatoes, 2. Wheat, 3. Clover, and 4. Oats. The potatoes get from thirty to forty tons of dung *per* acre; the wheat only a moderate dressing of

* Communication from Mr Hope of Fenton.

† On strong good soils, recently let, nothing but the deepest conviction of the advantages to be derived from that operation, could induce skilful and intelligent farmers to incur so heavy a charge, without the advantages of any crop, and paying at the same time, a heavy rent for the land thus occupied. Including rent, the expence of a complete over year's fallow, on good land, may be computed at from L. 5, 10 s. to L. 8 *per* acre.

hot lime. Under this, and other rotations of a similar nature, it is stated, that the land is apt to get foul, which would require a naked fallow, but the farmers have an aversion to that mode of improvement, and substitute, in its stead, what they call a *bastard fallow*, that is, three furrows after the clover has been cut; the land is then sown with wheat, and it gets a small quantity of dung.

An intelligent farmer near Edinburgh, (Mr Gray of Gorgie Muir), adopts the following rotation on his strong lands: 1. Potatoes; after being well cleaned by repeated ploughings, &c., and manured with from forty to fifty cart-loads of Edinburgh street dung, mixed and turned with his farm-yard dung, produce from forty to sixty bolls *per* acre. Where there is too great a proportion of clay in the soil, to grow potatoes to advantage, there *yams* for horses are planted, and this land is always kept in open drills, from planting to taking up; that is to say, without harrowing them down, as the others are done; and if it is not a very wet season, the produce is from thirty to forty bolls *per* acre, which he considers preferable to the crops of beans he used to have on the same land: 2. After potatoes and yams, wheat, (drilled, where the soil is light, by Cook's machine), and sown with grass seeds in the end of March, or beginning of April: 3. Clover, twice cut, and, 4. Oats.

This idea of cultivating yams instead of beans, on very strong lands, merits particular attention in this part of the kingdom *. Mr Robertson of Ladykirk, ob-

* On this subject, Mr Scott of Craiglockhart observes, regarding the feeding of horses, that of late years *yams* have been by many substituted for the evening feed. If work-

serves, that our southern neighbours have much the advantage of us in the bean husbandry. The great distress attending bean crops with us, is their lateness. In passing through the country near Aylesbury, he saw their beans *covering* the ground, and all in bloom on the 14th of June. Our wet weather generally commences about the 20th of October; before that period, in Scotland, the winter wheat should *all* be sown, but the beans are often in the fields. He is of opinion, that fallows may be much reduced in number, by carefully occupying the land, where the climate will admit of it, with drilled beans, but still that there is a certain description of land, that cannot be cultivated well, without occasional fallows.

Dr Coventry's opinion of fallowing is, that in the first rounds or courses of cultivating, a complete naked fallow is necessary: but in after courses, when the grounds have acquired a better texture, and are not so liable to become foul, they may be kept in good order by fallow or horse-hoed crops, such as beans, potatoes, common and Swedish turnips, cabbages, and any other species suiting the nature of the soil, and that mode of culture.

It is proper to add, that an intelligent farmer, (Mr Andrew of Tillilamb near Perth), when he fallows, *gives no manure*, as he finds that fallow wheat, with manure, is apt to be too luxuriant. Mr Allan of Craig-

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horses can subsist to equal advantage on yams and Swedish turnips: What a promising prospect for increasing the growth of wheat, and bringing fields to a high state of cultivation without losing a crop! One acre of yams or Swedish turnips will afford more subsistence for either horses or cattle, than two of oats or any other grain.

crook near Edinburgh, prefers also fallow without dung, which is becoming a favourite system in England. Mr Dudgeon of Prara, one of the most intelligent farmers in East Lothian, likewise contends, that if the land is of very good quality, a well prepared fallow, will often produce better wheat, without dung, than with it.

7.—OF THE CROPS COMMONLY CULTIVATED IN SCOTLAND, WITH SOME REMARKS ON DRILLING.

The articles principally cultivated in Scotland are not numerous. They may be comprehended under the following heads: 1. Wheat; 2. Barley, including bear or big; 3. Oats; 4. Rye; 5. Pease; 6. Beans; 7. Tares; 8. Turnips; 9. Carrots; 10. Potatoes; 11. Cabbage and kail, and, 12. Cultivated grasses*. As this work is not intended to be a treatise regarding every point connected with agriculture, but merely a condensed statement, of the information transmitted to me by the farmers of Scotland, regarding the system of husbandry pursued by them, it is proposed, in this place, merely to take notice of such particulars, communicated to me in the course of my inquiries, as seem to be entitled to attention.

1. *Wheat.*

The growth of wheat is greatly increased in Scotland. It is not only more frequently introduced into rotations,

* For the culture of flax and hemp, the reader is referred to the General Report on the Husbandry of Scotland now drawing up.

but is also cultivated in many districts where it was formerly unknown; and in situations, where, from their elevation, it was formerly thought impossible to raise it. In the parish of Temple, in East Lothian, for instance, it has already been grown, from 500 to 600 feet above the level of the sea, and some are trying it with success, even in higher situations*.

There is nothing that seems more likely to promote the successful culture of wheat in Scotland, especially in districts where the soil is cold, or the climate unfavourable, than to sow it early in autumn. In a farm, where a tenant had declared, that it would not carry wheat, that he had tried it often, and that it had not succeeded, a new possessor resolved to sow it on the 12th of August, and he had the satisfaction of cutting down his crop on the 10th of August in the following year. It would have been indeed cut earlier, had the weather permitted.

As it was, there was no farmer in Scotland, and few farmers in the northern counties of England, who had such a quantity, as 300 bolls of wheat, cut down so soon. It proved of uncommon good quality, and sold at a high price, for seed. It averaged about 9 bolls *per* acre, at 16 stone *per* boll †.

Another rule in regard to the culture of wheat is, that of sowing it in a dry bed. Baron Hepburn well ob-

* Communication from Mr George Farne, of Braidwood, near Dalkeith.

† Communication from Mr Allan regarding his farm of Oldliston. Mr Allan states, that early wheat, threshed in the month of August, does not require to be pickled or screened, as there is no ball or smut ever seen among early wheat sown at that time.

[serves, that the animal and vegetable kingdoms, bear, in this respect, a strong resemblance to each other; keep the feet of both dry, and no atmospheric cold our climate knows of will materially injure either.

It is also contended, that winter wheat, when the seed is harrowed in, should be covered to a sufficient depth, and should have, what is called, a good *grip* of the land, to prevent its suffering from rain and frost.

An intelligent farmer strongly recommends kiln-drying seed-wheat, as a better means of preserving the crop from smut, than the usual practice of pickling or steeping. From eight or nine year's experience, he states, that it has been found at least an equal preventive against the loss produced by that disease; and allowing it had no superiority over the method more generally in use, in respect to that property, still it would be entitled to a preference, because it can be kept without injury, should the weather turn out unfavourable for sowing at the time intended, which is not the case with wheat prepared in the other way; for unless it be sown almost immediately after pickling, it becomes unfit for seed, and can scarcely be applied to any other purpose. Wheat, to be prepared for seed by kiln-drying, ought to be completely dried, but not subjected to a heat which might in any degree scorch it*.

* Communication from Mr James Cuthbertson of Seton-Mains. This plan is mentioned in the original report sent to the Board of Agriculture, regarding the county of Clackmanan.

This information is strongly corroborated by the evidence of Mr Fowler of Prestonpans, who has in one year prepared forty bolls of wheat in this way for seed, and who has no doubt of its answering effectually.

The following is the substance of Mr Fowler's information on this subject:

1. The heat applied was 82° of Fahrenheit's thermometer.
2. The time of continuance depends upon the construction of the kiln, the quantity of grain dried at a time, and the moisture it contains; but wheat, in good condition, has generally been taken off as sufficiently dried, after being eight hours on the kiln.
3. The heat I have never regulated by a thermometer, but have fixed it as above, from what is given when pale malt is drying, with which it was the same, as nearly as circumstances allowed. My criterion of judging of the wheat was, by the appearance and feel it had, and as was mentioned in Mr Cuthbertson's original communication, care has always been taken, that the grain should be well dried, without being in the slightest degree scorched.
4. I never had any hesitation in allowing wheat to remain unsown several days after being dried, nor have I found this remedy less effectual, on account of its not having been immediately sown; I do not recollect, however, of ever having occasion to keep it beyond a week.
5. I conceive kiln-drying to be necessary for old as well as new wheat.
6. A considerable field of wheat, entirely free from smut, is, what I believe, has scarcely ever been found, nor is it ever considered materially injurious to the crop, unless it exists to that degree, so as both to affect the colour and quality of the flour, and since the introduction of the threshing-machine, by which the ball is preserved much more entire than by the flail,

wheat, if only slightly affected, can, for the most part, with good dressing, be almost entirely cleared of it: from the experience I have had, I never found the crop from seed prepared in this way, *completely* free of smut, and have only practised it, because I have found that it is equally effectual with the common method, and it is not attended with any risk of losing the seed, nor is the preparation so incommodious. 7. I have never made an experiment upon a very smutty sample of wheat.

The most important particular connected with the culture of wheat in Scotland, is the practice of sowing winter wheat in the spring months. Mr Brown of Markle states, that he commenced this practice as far back as the year 1779, as did his neighbour Mr Rennie of Fantassie, about the same period. It was sown by several people before that year, but not to any considerable extent, and only in seasons, when, owing to the wetness of October, it could not be sown at the customary time. It is of great importance to be able to sow wheat after turnips, for the month of March is not found too late when the season is favourable. Mr Rennie of Oxwell Mains, in East Lothian, states, that his March sown winter wheat, *anno* 1809, was as good, both in respect to quality and produce, as what was sown in November and December. He adds, that wheat sown in autumn, very frequently lodges in moist seasons, and on that account is deficient both in quantity and quality. On wet soils, the farmer often sows early in autumn, not from choice, but lest he should lose an opportunity of doing it. In regard to the difference between autumn wheat, and the same kind sown in spring, as to the number of bolls, he thinks that in ordinary seasons, the spring sown is equal in quantity

on light dry land, but not to be depended on where the soil is wet, and the climate not very early *.

* Though not strictly connected with the subject of Scotch Husbandry, I cannot deny myself the pleasure of inserting the following Note, containing some particulars transmitted to me by that celebrated farmer George Culley, regarding the spring culture of winter wheat.

“ Respecting the sowing of winter wheat in the spring, after turnips, I can speak in a very full manner, as I am persuaded very few farmers in this island have had more experience of that practice. I believe that spring sown winter wheat had not been much tried in this county before my late brother and I settled here in the year 1767. We had made some small trials in the county of Durham before coming north; but immediately on our taking Fenton farm, we tried it upon a pretty large scale, from one to 200 acres in the year. But for many years after we extended our farming concerns, we seldom grew fewer than 500 acres and upwards annually! and with never-failing success, one year excepted, when a partial mildew took place, until those last three fatal years, when most of the wheat in these northern parts of the island have been more or less affected with that dreadful malady! Not that spring-sown wheat was more hurt than the winter-sown, but perhaps less injured upon the whole. Nevertheless, I do not know whether I ought to recommend it to be much sown in the southern counties or not, because, in the trials we made in the county of Durham, we had nothing like such plentiful crops as we produce here.”

“ Besides, in the county of Durham, and all the way from thence to the southward, they can grow more barley in quantity, and better in quality, than we can by much, and it is also always much higher sold; consequently the growing of spring-sown winter wheat after turnips, becomes not so much a matter of consequence to them. Allow me to remark one thing, Sir John, which I cannot account for; we can perhaps produce the best oats of any in Great Britain, and yet we grow very indifferent barley. Perhaps, not only the friable fertility of our turnip soils in Glendale Ward, but the vicinity of the mountains, may be favourable to the production of spring-sown wheat; and I must now, Sir John, ask you a question, who has visited different climates, whe-

The real spring or summer wheat, has been of late introduced in various districts in Scotland. It possesses many advantages, being for a much shorter period in the ground; and though sown in the end of April, or the beginning of May, will ripen as early as winter sown wheat. It is certainly, however, not so productive as wheat sown in winter, or even winter wheat sown in spring; and the ear being shorter, the crop cannot be equally productive. It will probably, however, be a great acquisition in districts, where winter wheat does not answer, and more especially where the vegetation is rapid.

In regard to the culture of wheat in general, many intelligent agriculturists begin to be apprehensive, that from the high price of that article, farmers have been tempted to sow it too often, and that it comes round too

ther a more rapid vegetation does not take place in the vales adjoining mountainous districts, than at a distance from them? It is very proper in you to say, "winter wheat sown in spring," because a discrimination is highly necessary between winter wheat sown in the spring, and the Siberian, or real spring wheat. We tried the real spring wheat several years, but in both quantity and quality, it was invariably much inferior to the winter wheat sown in spring!"

"Prior to our coming into this district, no wheat was grown in Glendale, except in the haughs by the river sides, or some particular pieces of strong land, unfit for turnips. But now, and for many years, thousands of acres of spring-sown wheat have been grown with the greatest success, which had never produced any wheat before; and until these last unfortunate years, we seldom produced less than from three to four quarters *per* acre after turnips, and frequently more. Upon the weaker turnip soils, we *ourselves* sow a red wheat, the seed of which we got several years since from a village called Burwell, in Cambridgeshire, an excellent and productive kind."

frequently in the rotation. This may contribute to the mildew, which has of late affected that species of crop, and which was certainly never formerly known to such an extent in Scotland.

2. *Barley.*

This species of grain was formerly the great favourite of the Scotch farmers *, before that, by the introduction of fallows, crops of wheat were rendered more certain and productive; but now barley is condemned as the least profitable of any of the white crops, as not being so prolific as oats, nor so profitable as wheat. It is remarked, that all crops are robbers of the earth, in proportion as they are heavy in grain upon the acre, and produce the least weight of straw, to be converted into manure. Hence barley ought, in general, to be accounted a more severe crop than either wheat or oats, because the straw neither gives equal food to the animal, nor dung to the earth, and of course is not so profitable to the farmer, unless upon particular soils †. Good farmers, therefore, will not persist in barley, if their lands are suitable for wheat or oats.

Whilst barley is thus condemned, the culture of bear or big is strongly recommended, more especially in the northern districts. An intelligent farmer in the Mearns assigns the following reasons for preferring bear. The

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* Some farmers particularly recommend sowing barley as early as the beginning of March, as the best means of securing an abundant crop.

† Clover succeeds better after wheat than after barley, probably owing to the straw being stronger.

crop of grass, he observes, is almost constantly good or bad, in proportion as the ground is more or less pulverised ; and as bear may be sown three, or perhaps four weeks later than barley, it may be done at a season when the land can be brought to a finer tilth. If the grain crop should happen to fall over, as bear will be sooner ripe than barley, by being earlier taken off the ground, the danger of rotting the grass is less ; besides, that it has thus an opportunity of being well advanced before winter, if the autumn should prove good ; and in this climate October is often a mild month. In northern districts the earliest grains ought to be cultivated ; and barley is not only later than bear, but it requires to stand longer in the stook before it be fit for stacking. No doubt barley is the more valuable grain of the two ; but that cannot be put in competition with the risk of a late and precarious harvest, and perhaps the loss, or at least the deterioration of the two following crops of grass, and by which, not only the food for cattle is lessened, but the land becomes fouler ; for weeds will vegetate if the land be unoccupied. The produce also from bear will be found to be greater than from barley, although perhaps overlooked by the farmer, as he generally sows the latter on his best land. On tolerable farms, the inferior land will yield nearly as much bear as the best will barley ; and had bear been substituted on the latter, the produce would have been much greater. But on ordinary land, yielding a tolerable crop of bear, there will be a considerable deficiency of barley *. How unfortunate

* Mr Grierson, late corn-merchant in Leith, who had much experience and knowledge in the corn-trade, transmitted to

it is, that the culture of so useful a crop should be checked by improvident sanction, and the laying an unequal

me the following observations on the subject of bear, and on the feeding of horses with that article.

“ When bear, or what is called big in England, is of the same weight, I give the preference to big, 1. Because it produces the finest worts and distilled spirits; and, 2. Because it has less draff or grains. 3. It will produce more meal, finer, fairer, and more palatable for bread. 4. It is better calculated for pot barley, because it is shorter in the grain than the two-rowed barley, therefore not so much waste to bring it to shape; it boils softer and eats sweeter. 5. It is better for feeding horses than barley, and better than oats for horses not much wrought in dry countries, but not so good as oats in wet countries, or in wet roads, where horses require more heating food *. But were I to feed horses to most advantage, I would feed with beans and oats, but ground as small as malt. It is hardly to be conceived, the difference of the ease to a hard-wrought horse who has ground meal to eat, and one that has his oats to eat whole, as he has not half the time to rest as the one that has ground corn, and cannot perform the same labour, or last so long. This is a most important consideration where so many horses are necessary for agriculture; and a very trifling expence would add a grinding machine to the thrashing-mills, for all the corn necessary for feeding the horses and pigs on a farm. The difference of price between barley and bear can only be from the weight, and perhaps something in the soil, and earliness or lateness of the harvest; but both being equal, I would give the best price for bear, for either beer, spirits, or bread-corn.

That bear is not more cultivated and in higher request, is owing more to prejudice than any thing else; for it is well known, that it produces more seeds than barley, and is less injurious to the ground; and may be sown for twenty years on the same ground, without either lessening the produce or impairing the quality, provided the land is fallowed before

* According to this remark, big would be the best food for horses in England and Scotland, during the summer season, which would be a great point to establish.

and disproportionate duty on the malt made from bear, compared to that made from barley.

3. Oats.

There is no species of grain that succeeds better in Scotland than the oat, and some farmers have given up sowing barley, as it never comes within two or three bolls *per* acre of oats, as the straw of it is much inferior, either for feeding live stock, or for producing manure, and as the sale of it is uncertain. Oats are also preferred, in some cases even to wheat, as it has been found that sowing oats after grass, is more advantageous than sowing wheat, however profitable that article may be *. Oats also are a better crop after pease; than even after grass †.

It is well known, that various sorts of oats are cultivated in Scotland, as the Dutch, the Blainsley, &c. In sheltered situations, and in rich soils, the variety called the Potato Oat is to be preferred; but in exposed fields, Mr Brodie of Garvald greatly prefers the red oats. They unite the advantages of earliness, good grain, and a power of resisting the wind, equal to any other; and by growing them, farmers are enabled to cultivate higher grounds, than otherwise they could venture to do, with every prospect of reaping the fruits of their labour.

winter, and twice ploughed before sowing, with a sprinkling of dung. It is very seldom more than ten weeks on the ground in favourable situations, and barley never less than fourteen.

* Remarks by Mr Trotter of Newton in Linlithgowshire.

† Remark by Mr Charles Alexander, Easterhaprew near Peebles. It is proper to observe, that when a field is fallowed, any mossy part of it should be sown with oats instead of wheat.

Another variety, called Church's Oats, are much in request*. And there is also a kind of oat called the

* The following particulars regarding Church's oats have been transmitted to me by the son of the farmer by whom they were first propagated. They are generally sown, he states, from the middle of March till the end of April, but if they are grown for early cutting, they are sown somewhat sooner. They ripen a fortnight or ten days earlier than the potato oats sown on the same soil at the same time, and are generally cut in the first or second week of August. As they are subject to shake, they require to be cut before they are quite ripe, or when the stalk immediately below the ear is of a pale pink colour, inclining to yellow. They are sown at the rate of about six Winchester bushels *per* acre, and yield from sixty to eighty Winchester bushels *per* English acre, and there are instances of their doing more. They require to be sown on dry land in good condition, and prove most productive on a friable loam, either after grass or turnips; on such land they are perhaps not surpassed in increase by any other. They are a round plump oat, resembling in this respect the potato sort; but they are larger in the grain, and rather thicker in the husk or skin. They sometimes have a small bosom pickle attached, and frequently none, and when they are good, they have scarcely any or no tail.

Being of an early quality, they have frequently proved a public benefit, by being made into meal, and sold before general harvest. Some years ago they were generally cultivated in the most improved districts in the north of England and south of Scotland, till the potato oat began to supersede them, as they were found nearly as productive, and not quite so liable to shake; neither do they require the land to be in so rich order to produce a good crop. The first his father got was from an acquaintance, and only amounted to sixty grains. He planted them on the 14th June 1776, and for twenty-five years or upwards, he grew them on the same kind of soil, without degenerating; but they have now rather declined in quality, (perhaps owing to want of care in preparing and selecting the seed, since the potato oat has interfered, to diminish their reputation. The farmers on the east coast, are now beginning to grow them to a greater extent than they have done for some years, and that a farmer

Barbauchlin Oat, which is much recommended. Mr Blackie of Holydown, has had a few acres of them for years back. They are coarse in the grain, but very prolific; the straw, which is strong, answers very well for cattle in a straw-yard, and they produce one-fourth more straw than any other kind. They give perhaps one-tenth part less meal than potato oats, but they ripen nearly as early. It is supposed that they would answer very well in the northern districts, where the soil is sandy with a kind of gravel. They now sow a considerable share of them in Galawater.

4. *Rye.*

This species of grain is not very extensively cultivated in Scotland and the winter sort, without which the countries on the coasts of the Baltic could hardly be subsisted, is almost unknown. My principal reason for mentioning it at all is, that in the opinion of a most intelligent practical farmer in Roxburghshire, rye, on moorish grounds, is a more certain crop than oats; a fact little known, but of infinite importance in carrying on the improvement of our barren districts.

5. *Pease.*

For some years past pease have been a precarious crop in Scotland, principally owing to the continual rains in

there, had last year potato and Church's oats sown on a rich field of equal soil. at the same time, and that Church's oats yielded fifteen Winchester bushels *per* English acre more than the other. It would be very important to raise a variety from Church's, or some other species of oat, without a blossom pickle, as the grain would be more equal in point of size and quality, and less liable to shake.

the month of August, which kept the pease constantly in a growing state, in consequence of which the pods did not fill till the frost came on. Had there been dry weather in the months of July and August, the crops would probably have been abundant*. It is now, however, pretty well ascertained, by the experience of Norfolk, that a crop of pease will not succeed, if sown on the same land, above once in ten years.

Some farmers who find that clean pease will not answer, sow pease and beans alternately, with a hand drill, the rows at twenty-seven inches distance, so as to admit the horse, and the hand-hoe at discretion. Mr Hope of Fenton, finds, that this plan answers better than sowing these crops separately.

It is surprising that the tenants near Edinburgh have not attempted to raise early pease, an article which sells at so high a price in the Edinburgh market, during the month of July. About twelve years ago a gentleman sowed two acres with white pease, and sold the whole by the middle of July, at L. 35 *per* acre. Immediately afterwards, he prepared the ground for turnips, which were sown by the end of that month, but unluckily the seed was bad, and the turnip crop almost totally failed. He had no doubt of his making from L. 40 to L. 50 *per* acre of the two crops.

6. Beans.

It would be a very great improvement in husbandry,

* Observations by Mr Neil Ballingall, in Fife. Mr Hume of East Barns, near Dunbar, remarks, that pease is not worth the raising. They can grow plenty of pease-straw any year, but their produce in grain will, in most cases, not pay the expence of labour. Ought not the early white Norfolk pea to be tried?

more especially in Scotland, if an early bean could be discovered, which would bear to the common bean, the same qualities, that the hot seed does to the cold seed pea : this would remove the principal obstacle to the bean husbandry in Scotland, the lateness of the crop ; and it is certainly lamentable to see the bean crop out in the fields, while with a better climate, the land ought to have been sown with wheat. Some improvements, however, in the harvesting of beans will be afterwards described, which may tend to remove that objection.

Some farmers prefer broad-cast to drilled beans. A spirited farmer, during the three first years of his lease, tried the following experiment. He had part drilled, and part broad-cast, but the broad-cast always turned out best. The drilling of land in beans suffers sometimes (when done either across, or to angle the ridges) in the dressing, the furrows always filled up in the time of horse-hoeing, and in wet weather, which often happens when the land is so laid down, sours the furrows, spoils the crop, and destroys the land for after cropping. Whereas when sown broad-cast the furrows are cleared, and stand so from seed-time till harvest, and generally a weightier crop, which pulverizes the soil, and keeps the land clean, equally if not better. He admits, however, that upon easier soils than what he possesses, the drilling of beans is an excellent system, when the land is clean of couch-grass *.

* Communication from Mr Henry Thomson of Muir-town of Balhousie near Perth. Mr Hume of East Barns, observes, that beans cannot be planted too near the surface, if they are covered at all.

7. *Tares.*

This article is not much cultivated in Scotland, a few acres on every farm being only raised for soiling horses, between the cuttings of clover; but a spirited and intelligent farmer near Edinburgh, (Mr Allan of Craigcrook), has carried it to a still greater extent. He considers tares one of the most valuable crops he can cultivate. If taken to market green, they bring L. 25 *per* acre; and when kept for seed, twelve bolls may be got *per* acre, which, Mr Allan says, will fetch from L. 3 to L. 4 *per* boll. The proper time for sowing tares *for seed*, is about the second week of March*, in drills about thirty inches wide; and three firlots of tares, is, in that case, a sufficient quantity of seed, but it is thought better to sow rows of beans and tares alternately, as the beans keep up the tares; in that case, half a boll of tares, and the same quantity of beans, is sufficient for seed. In favour of

* Mr Kerr observes, that the time mentioned is very proper for a crop of tares *intended for seed*. But what are wanted for cutting or soiling, ought to be sown two or three times, to give a succession. The first as early in February as the season will allow, to come in immediately after the first cutting of clover. A second crop, in the beginning or middle of March, to stand for seed. And a third sowing in the end of March or beginning of April, to cut green for the horses during harvest. Beans answer excellently, to stake the tares intended for seed; but those which are meant to be cut green, ought to have a small admixture of oats; which both serves to hold them up, admits the air, aids the scythe, and increases the food.

It is a pity our Scots climate does not answer for winter tares. Mr Kerr tried them twice ineffectually; but was told they sometimes come forward to cut before clover, but very rarely. The earliest sown tares in spring, should, however, be of the winter sort, being the hardiest.

this crop, it is asserted by Mr Allan, that a crop of wheat after tares, without dung, will be as good as after drilled beans with dung.

It may be proper here to observe, that tares delight in a new, and even tilly soil. It is possible, therefore, that they might answer on fallowed grounds sown as late as May, and might be cut in time enough for sowing wheat. The soil might be protected by them from the exhaling influence of the sun, and kept in a moist and mellow state for the reception of the seed wheat. This plan, however, will not answer, where the land is not clean, as it would interfere with the fallow process.

8. *Turnips.*

Drilled turnips is one of the great boasts of Scottish agriculture, and though the idea of drilling them was originally taken from the celebrated Tull, yet the precise mode of conducting this operation, now universal in this country, certainly originated in North Britain.

It is unnecessary to detail a process so well known, and which has been so frequently described. It may not be improper, however, briefly to consider the following particulars: 1. The different sorts of turnips cultivated in Scotland; 2. The produce of each sort; 3. The manner of consuming them; 4. The modes of preserving them; and, lastly, Any miscellaneous particulars, which may be entitled to notice.

1. The sorts commonly cultivated in Scotland, are known under the name of the Common Globe Turnip, the Yellow Turnip, and the Swedes, together with the White Norfolk, for early eatage by sheep.

An interesting experiment has been tried by Mr Blaikie, a native of Roxburghshire, but bailiff to the Earl of Chesterfield, with the three first sorts. The globe

turnip produced the largest crop, but was the most tender; the yellow proved a fine crop, was more nutritious than the globe, and stood the winter better: the Swedish turnips maintained their superiority for hardiness; the yellow Scotch was next in rotation in regard to that very essential quality.

The yellow Scotch field turnip may be considered as a valuable acquisition, for the following reasons:—1. It is more hardy than the globe, decanter, fankard, red top, green top, or any variety of the Norfolk turnip.—2. It does not draw more nourishment from the ground than any of those varieties, consequently does not require that any extra preparation should be made for it.—3. It is not so hardy as the Swedish, but has the advantage, in not requiring so much manure; does not draw the ground so much, nor does it require to be sown so early by a month, which gives time for cleaning and preparing the fallows, which are too often but imperfectly cleaned when the Swedish are sown.—4. The yellow Scotch is also a good table vegetable, being palatable, more nutritious, and not so watery as the Norfolk varieties.

When Swedish, yellow Scotch, and Norfolk turnips were strewed indiscriminately over a field, and cattle and sheep turned to them, the stock were observed to select the yellow Scotch, after being used to them.

It may be proper to add, that the yellow is by far the best turnip for milch cows, and that they thrive much better than the Swedes in light soils.

In regard to the Swedes or *ruta бага*, they are of so hard a nature, as to be very pernicious to the teeth of stock, particularly the very young or the very old. They require also rich land, or a great deal of manure. They may be transplanted, but in that case do not come to the same size as those which grow upon the spot where they were originally raised.

2. The produce of the turnip crop necessarily varies. Mr Paterson of Castle Huntly found that his globe or common turnip weighed fifty tons *per* acre, when entire, but only forty-six tons when the tops and tails were cut off. Mr Allan of Craigcrook states, that on his farm at Oldliston, the common white turnip weighed from forty to fifty tons *per* Scotch acre, and the *ruta бага* from fifty to sixty tons.

3. The mode of consuming turnips, by feeding cattle and sheep, is well known; but there is one mode of giving them to sheep, adopted by Mr Hunter of Tynesfield in East Lothian, which seems to be peculiar, and to merit particular attention.

He states, that he has been in use for several years past, to turn part of his straw into manure in winter, by folding sheep, and giving them turnip on the top of the straw. In 1808, he had 300 sheep, mostly black-faced wedders, three year old from the Highlands, at L. 20 *per* score, fed on turnip in the following manner. A fold, containing an English acre, was made in the corner of a field on a southern exposure, sheltered from the north and west by a strong thorn hedge: the whole fold was then covered with straw a foot thick. The sheep were turned in, and turnips carted and laid on half of the fold upon the straw, and a daily supply was continued on the same half till the straw under them was a little wet: the turnip was then laid on the other half, covering that part where the turnip had been first laid with fresh straw, and he continued to change from side to side once in two or three days, always giving fresh straw the whole season. The sheep lay very dry, the straw serving as a drain to receive moisture. As the *palm* or chaff upon the straw was eaten by the sheep, they fatted apace, and were sold in March at L. 42 *per* score. The quantity of manure produced was very great, (no doubt partly depending on

the quantity of straw used), in one year not less than 800 tons of the best manure he ever saw on his farm. He prefers this method to wintering of cattle on it, first, because the sheep eat less, of course more manure is gained; and in the second place, because he finds the quality richer.

This excellent mode of raising abundance of rich manure, cannot be too strongly recommended.

Several intelligent farmers have of late years grown *ruta бага* or Swedish turnips, for horses and for other stock, during that critical period when the common turnips fail, and grass has not yet become abundant, and for these purposes this esculent is invaluable. But Mr Church of Hitchell observes, that where the soil is thin and dry, it is impossible to raise a good crop of Swedes under any management. He therefore begins to entertain an idea of substituting potatoes in their room *.

4. Mr Blair of Montague, near Perth, on the first appearance of severe frost, has been accustomed, for thirty years past, to store up turnips, cutting off their tops and tails, and thus preserving them sound and good for three months, much to the advantage of his farm; and Mr John Shirreff has received a gold medal from the Society of Arts, for communicating to that public spirited institution, a simple mode of drawing and stacking, either the

* Mr Kerr observes, that potatoes, he understands, are now very extensively applied to the use of cattle and horses in Lanarkshire. If this is ultimately found to answer, and the practice become universal, it will secure the country against the possibility of famine in the very worst of years. It will become a source of tangible human food, usually applied to animals, who may be supplied from other sources calculated for their subsistence. In a year of dearth, the high price of potatoes, will naturally induce the farmers to stint their cattle, for the supply of the people, and to replenish their own pockets.

whole, or the greatest part of his turnip crop for several years in autumn, intended to be consumed during the following winter and spring, a practice which he found attended with much convenience, economy and emolument *

5. The celebrated George Culley, has communicated to me a fact, which, though perhaps known to many intelligent farmers, may not be so universally propagated as it deserves to be. It is this; that all *crude soils*, or even such soils as have been cultivated, but which have had little or no calcareous matter mixed with them, will produce better turnips, with a good dose of lime or shell marl only, without any dung whatever, than with dung without any lime or other calcareous substance. This he finds from long and repeated experience.

It is said that the turnips in Berwickshire are seldom injured by the fly. This may perhaps be attributed to the superior culture, for which that district is so much distinguished, by means of which the young plants are enabled to push away at the beginning with more vigour than when the management is less perfect; for it is a general observation, that the more rapid the vegetation of the plant, the better is it able to withstand the effect of the insect's depredations.

It has been remarked in Banffshire, that mixing earth or moss with the offals of fish, makes an excellent compost, particularly for turnips, and that the best turnips are always after fish dung. This should be attended to on the sea-coast, where such quantities of fish, and of fish offal may be had.

It may be proper to add, that since the stoppage of the distillery, and the scarcity of grain for feeding milch-

* This useful communication is printed in the 22d vol. of the Transactions of the Society of Arts, p. 118.

cows, turnips have been the most valuable crops raised in the neighbourhood of Edinburgh, and that they have sometimes sold so high, as from L. 30 to L. 36 *per* Scotch acre.

9. *Carrots.*

This species of crop is not so much cultivated in Scotland as it ought to be. Its culture seems to be attended with no more difficulty than that of cabbage, potatoes, or turnips, and if properly cultivated, with little or perhaps no more expence. An active improver, (Mr Alexander Guthrie,) states, that in his attempts to raise the carrot, with hardly any exception, he has succeeded beyond expectation. For working-horses, he knows no food equal to carrot, and of this he has had complete experience. Were the growth of carrots general over the country, and used as food for working-horses, he is of opinion that two-thirds of the oats consumed for that purpose might be saved. In years of scarcity, this would be of great advantage to the nation, and a blessing to the poor.

Mr Butterworth informs me, that he has cultivated carrots for seven years upon the same ground, without dunging, and with great success, and had one year twenty acres, which he sold at 5 d. *per* stone, and two acres and a half for L. 60 Sterling, without being at the expence of raising them.—He ploughed the ground in October* in the common and ordinary way; in March he ploughed it again, in the same manner, and harrowed it well, and where it was sheltered, he sowed the seed immediately after the harrowing, that the weeds might not get start

* In Suffolk, autumnal ploughing is found much to increase weeds, and to add to the expence of hoeing.

of the seed, which is of great consequence : the drills * were made at one foot asunder. He then rolled the ground with a heavy roller, drawn by two horses : when the rows appeared, he run the Dutch hoe betwixt the rows, and hand-weeded the rows, leaving the plants four inches asunder : in about three weeks after he weeded a second time, and kept them very clean. In October, he cut off the tops with a scythe, and raised the carrots by ploughing the ground in the ordinary way, as many as he wanted ; but where the ground was dry, he let them remain with their tops on, to guard them from the frost, and raised them as he had occasion : frost destroys them if left in wet ground during the winter ; but in dry ground they keep best till the spring, when they begin to grow, and should be raised in March. He sowed about 7lb. of seed † *per* acre, and they yielded a profit equal to wheat, and improved the ground till it was absolutely too rich for carrots, and he had the best crops of barley and wheat after, that could be imagined : one acre produced nineteen bolls and a half of wheat, and was very indifferent ground before it was improved by the cultivation of carrots. He sold the spot, which was at Burnhead and Stonehouse, near Liberton, twelve years ago, at more than double the price he paid for it, without any improvements, except by cultivating carrots upon it ; on an average he had about

* Drilling has been tried in Suffolk, but did not succeed. Here is no mention of steeping the seed, which is found very important in Suffolk.

† Never more than 5 lb. of seed sown in Suffolk broadcast by the best farmers ; the seed being good, that is to say new.

2200 stones *per* acre *. Where the ground was cold, and not sheltered, he did not sow till April.

Mr Guthrie adds, that in the attempts he made to steep the seed, he partly succeeded, and partly failed; the seed being bad, it was steeped in pure water twenty-four hours. He has tried to transplant carrots, but did not find it answer. He does not think it a good plan to cut off the tops, the second growth coming too late to protect the carrots from the frost, as he allowed them to remain in the ground during the winter. He has given them to his horses during the whole of April quite sound and fresh, and they eat the tops as well as the root.

Mr Paterson of Castle-Huntly also cultivates carrots. He cuts the tops as required, and gives them to the cows; the produce of one acre of which, this year, served to support nine milch-cows for a fortnight; after which the carrots were taken up with the plough; the remainder of the tops cut quite close to the body before housing.

Mr John Shirreff has made an interesting experiment, on a small scale, to ascertain, whether carrots are deteriorated, or otherwise, by cutting off their tops in summer, and converting them into hay.

Weight of the roots of the carrots, grown on a small piece of ground, drawn and weighed on the

	lb.	oz.
30th November 1810,	16	4
Ditto of the leaves,	8	0

	24	4
Ditto of the leaves cut on the 7th of August,	7	8
	<hr/>	
Total,	31	12

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* The produce, which is $13\frac{1}{4}$ tons *per* acre, is a fair common crop in Suffolk on good lands.

Weight of the roots and leaves of carrots grown on an equal extent of land, and of similar quality, drawn and weighed on the 30th of November			lb.	oz.
1810,	-	-	46	2
Weight of the leaves alone,			13	12
			<hr/>	
Roots alone,			30	6
			<hr/>	

Thus it appears, that the roots alone of the carrots, the leaves of which were not cut till they were drawn in November, amount to a greater weight than both the leaves and the roots of the carrots that were trimmed over on the 7th August, and that the difference on the whole was nearly 50 *per cent.* on the one produce, and to 30 *per cent.* on the other.

It is also proper to observe, that the weight of root, which is the most valuable part of the plant, is nearly double in what was uncut in summer, whereas the extra growth of leaf in consequence, of summer cutting, is only about 12 *per cent.* at the utmost.

In regard to the culture of carrots in Scotland, it has been ascertained, in the most satisfactory manner, that they can be raised on peaty soils with the greatest success. The following account of this important fact I have received from a respectable proprietor in the county of Fife *.

* It is well known, that carrots delight in a soil, where they find no difficulty in striking their roots downwards. Deep sandy soils were therefore recommended for that valuable article, but there is reason to believe, that peaty soils will be found greatly preferable.

A gentleman in the north of Scotland, being desirous of cultivating that root, and understanding that celery thrive

10. *Potatoes.*

The culture of potatoes has greatly increased in Scotland, owing to the following circumstances. 1. The ex-

well on peat, he resolved to try, whether carrots, also, would not answer; and he pitched on an acre of low meadow-ground for that purpose, which might have been converted into peats for fuel. It was trenched in November 1805, and a crop of oats taken in 1806. After the oats were removed, a moderate quantity of rotten dung, and some lime, were laid on the ground, it was then dug over with the spade, and in spring 1807, sown with carrots in drills.

In the beginning of the year 1808, the ground got a small quantity of dung, and was again dug over with the spade, and sown with carrots. The crop was very abundant, and some of the carrots measured eighteen inches in length, although the ground was only trenched to the depth of a foot.

The quantity *per* acre was from thirteen to fourteen tons, which was sold, when delivered at Leith, for 7 s. 6 d. *per* cwt., or L. 7, 10 s. *per* ton. The produce of an acre, therefore, when the crop answers, is immense. The value of carrots, as food for cattle, is well known, and it must be of peculiar consequence, therefore, in the Highland districts of the country, to cultivate that root.

From 168 to 200 carrots weighed one cwt., and, when sold in the Edinburgh market, fetched, even the small sized, 1 d. *per* piece, and the larger sorts 1½ d., and even 2d. each.

The principal difficulty is to get good seed. If that can be obtained, no crop will repay so well the expence of cultivation on a peaty soil. Suffolk is the best county for obtaining it.

The quantity of good seed required *per* English acre, is from 6 lb. to 8 lb. As farm-servants are not well acquainted with the culture, it is best to sow the larger quantity. The price varies, according to the season, from 1 s. 6 d. to 2 s. *per* lb. The proper season for sowing field carrots, is from the middle to the end of March. They should be sown in drills, but not in raised ridges like turnips, and not rolled. The drills should be eighteen inches apart, if drilled

cellent mode in which they are raised. 2. The demand for them at market. 3. Their proving so valuable a preparation for crops of wheat; and, 4. The custom adopted by farmers, of giving portions of land for raising potatoes, both to their own servants, and to the inhabitants of any neighbouring town or village.

1. Nothing can be superior to the mode of raising potatoes by the plough, and in drills. The following account of that process, though peculiarly applicable to the neighbourhood of Glasgow, does not vary materially from the practice usually adopted in other parts of the kingdom.

The ground is prepared for a potato crop by ploughing in winter, or rather in autumn; and to keep it dry, during winter, the ridges are gathered, and the furrows kept clear. It is sometimes ploughed once, and sometimes twice, and well harrowed during the spring, and the drills being formed, the dung and cuttings are put in and covered with the plough. In sandy ground the cuttings are put below, and in heavy soil above the dung. The potatoes are dressed in summer in the ordinary way, the drills being pared or sliced, horse-hoed, hand-hoed, weeded, &c. as in other parts of the country.

In regard to the produce and value, that must vary according to the condition of the ground, the time and manner of culture and cropping, the season, and

on level ground with a hoe; but if done with a plough as turnips, they would require two feet.

To those who have peaty soils already in cultivation †, a trial of so promising an experiment, is earnestly recommended, and that they would be pleased to communicate the result, to the President of the Board of Agriculture.

† When peaty soils are first cultivated, they ought always to be trenched in the beginning of winter, and exposed to frost. If dug in summer, the heat of the sun hardens them, and converts them into peat for fuel. But old peaty soils, may be trenched for carrots in spring. The produce has amounted even to 16 ton *per* Scotch acre.

other relative circumstances. A potato crop will average from 40 to 50 bolls *per* acre. They will sometimes fall short of 40, but many have reaped more than 60 bolls from one acre. General Spense sold last year a potato crop, for part of which he was paid L. 29 *per* acre, and potatoes were raised from part of the field, at the value of 80 bolls *per* acre. Andrew Moodie, Esq; reaped, for a first crop, upon deep moss, near Paisley, from $17\frac{1}{2}$ acres, near one acre of which was occupied with roads, ditches, &c. 774 bolls of potatoes, which he sold at L. 418 : 6 : 2. Robert Cameron, in East Walkingshaw, near Paisley, raised 60 bolls *per* acre, from moss-ground. Potatoes are usually sold at from L. 18 to L. 28 *per* acre, the purchaser digging up and removing the crop. In a field, near Elderslee House, potatoes, planted without dung, after a crop of oats, from old rested land, to which no manure had been given, sold at L. 27 *per* acre.

Mr Andrew of Tillilumb, near Perth, adopts the following plan in the cultivation of potatoes. 1. He cross-ploughs. 2. Puts in the dung. 3. Ploughs a second time; and, 4. The ground is either drilled for potatoes, or another ploughing given, and the potatoes planted after the plough in every third furrow. He usually follows the last mode, as he thinks it best calculated to do justice to the ground, and generally brings a good crop. The expences, besides rent and dung, may be stated as follows :

Seed <i>per</i> acre, $2\frac{1}{2}$ bolls, (32 stone Amsterdam,) at 12 s.			
<i>per</i> boll,	-	-	L. 1 10 0
Cutting seed,	-	-	0 2 6
Planting,	-	-	0 4 0
Cleaning, after being horse-hoed,	-	-	0 12 0
			<hr/>
			L. 2 8 6

Potatoes at Perth sold this year at about L. 15 or 15 guineas *p.* Scotch acre; and if L. 5 is supposed for rent, and L. 5 for dung, it will appear that there is not too much for so much labour, and that the chief profit lies in the state of preparation the ground is brought into for the succeeding crop. In a wet season, potatoes do not answer upon heavy land *.

The average produce of potatoes near Edinburgh, is from 40 to 60 bolls *per* Scotch acre, and the average value from L. 20 to L. 25.

2. The consumption of potatoes is annually increasing in Scotland, every prejudice against the wholesomeness of that root having been long ago exploded. The simple modes in which they can be prepared for the table, is of the utmost advantage to the poor; and by the addition of salted herring, both the taste, and the nourishment afforded by that useful article, may be improved. It is difficult indeed to conceive how the people of this country could have subsisted, had it not been for the fortunate introduction, and extensive culture of, this most valuable plant.

3. Potatoes are found an excellent preparation for crops of wheat. The frequent ploughings necessary for raising

* The following is the expence of cultivating one acre of potatoes near Dalkeith.

Dung, 40 single-horse carts, at 5s.	-	L. 10	0	0
Three ploughings and harrowings,	-	2	0	0
Seed, cleaning with horse and hand-hoe,	-	3	10	0
Taking up and housing,	-	2	10	0
Rent,	-	5	5	0
		<hr/>		
		L. 23	5	0
		<hr/>		

that article ; the quantity of dung allotted for it, the frequent hoeings, the stirring which the ground receives when they are gathered, (sometimes perhaps more than is necessary), and the favourable period of the year when they are taken up, are excellent preparations for the culture of that important grain. Wheat after potatoes, therefore, is almost universal, wherever both are cultivated.

4. The culture of potatoes is very much increased by two practices : 1. That of farmers giving a certain portion of land for raising potatoes to their servants, they furnishing the dung, and the farmer the plough and the horses ; and, 2. By a practice of farmers in the neighbourhood of towns and villages letting land to the inhabitants for the same purpose, they furnishing both dung and labour. Near Cullen, in Banffshire, they get a fall of ground for a load of dung, which the farmer puts on his turnip field, as the people consider the potatoes of a better quality when raised without dung. Mr Stewart of Hillhead, by letting an acre for potatoes, gets the labour of 120 reapers *. They give the seed only, and take up the crop. The land is let to labourers and tradesmen in a neighbouring village. The value of the potatoes is more than ordinary wages, and they are maintained the days they work, but it is a great advantage to have

* An acre of potatoes gives 120 days reaping, (*shearing*,) at 55 yards for each day, the drill being 34 inches wide. The acre thus pays L. 9, the reaper furnishing seed ; the wages, reckoned at 1 s. 6 d. besides victuals, which together make 2 s. 2 d. *per* day. The reaper (*shearer*) has his potatoes at nearly 20 s. the ton, often much less : the advantage of the farmer is, having these reapers at his call, and only on the days when required.

a number of labourers at command, more especially during a critical harvest.

Attentive farmers do not neglect to cut off the tops of potatoes and yams, if possible before the commencement of frost, and at any rate before they take up the roots, which is the means of saving food that otherwise would be lost, and at any rate the tops make good dung.

Mr Church of Hitchel states, that he has grown, within these few years past, a variety of the potato, more productive than even the Surinam potatoe or yam, and they have also this advantage over the latter, that they boil or steam readily, which the yam does not. He has had from ten to twelve tons *per* Scotch acre of them, which is a greater weight than he ever obtained of Swedish turnips. These newly-introduced potatoes have a dark green haulm, and no blossom or apple. Sheep stock seem to thrive upon these potatoes, in even a raw state, as he fed his breeding ewes for some weeks upon them last spring, which he was under the necessity of doing by the failure of his turnip crop.

From the great size to which they attain, they have lately been distinguished, in the county of Dumfries, by the name of the Patagonian Potato. In Cumberland, they are called the Bullock, being much used there for the purpose of feeding cattle. Their cultivation is in all respects the same as that of the common potato. Mr Church having a considerable stock of them, can supply any person with seed.

II. *Cabbages and Kale.*

It is said that cabbages, when properly cultivated, yield more food for cattle than any other crop whatever. Mr Waddell at Dockenyfauld, near Glasgow, raised cabbages on his farm, at the rate of 50 tons *per* acre, and

putting them up to the neck in earth, and covering them with straw, he thus preserves them for his cows till the month of February.

Mr Scott of Craiglockhart observes, that an inexhaustible fund of manure might be obtained, by cultivating cabbages for autumn food. A careful hand will find as many pickings from an acre of thriving cabbages, as will plentifully feed six or seven head of cattle, from the middle of September to the middle of November. Feeding solely on them much longer is not so proper.

The same intelligent farmer observes, that cabbages should be cultivated as green food for cattle in autumn, and green kale for the same purpose during the months of March and April, which last is certainly the scarcest period of the year for food to stock, more especially in high situations.

To what extent cabbages ought to be cultivated in Scotland, will be the subject of future consideration.

12. *Artificial Grasses.*

Red clover, with a mixture of rye-grass; white clover and yellow clover, and sometimes rib-grass, are the grasses almost universally sown in Scotland. Some experi-

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* Two experiments have been reported to me of the culture of lucern in Scotland, one by a proprietor near Edinburgh, who has about three acres of this plant, with which he maintains ten or twelve horses during the summer season. The other is by Mr Duffin, vinegar merchant at the Abbey. He has had it for several years growing in a plot of his garden; the plot is not near a rood, and it maintains one horse to him during the summer months: he has three luxuriant cuttings, and an after cutting in the end of autumn. From the first sowing it grows annually; it lasts from ten to four-

ments have been tried with lucern *, sainfoin, chicory, &c., but not to an extent entitled to any particular notice.

The introduction of red clover is one of the most fortunate circumstances that could have happened to the husbandry of Scotland, more especially since the mode of cutting it green for stock, or soiling, has been adopted; the produce is immense, whilst from the size of its root, which remains in the ground, it does not exhaust, as otherwise would be the case. It is also an excellent preparation for other crops. Many people imagine, that the land grows sick of clover, but, to any extent, that is to be attributed to the want of deep ploughing, as clover delights in new soil, in so much that when it is at first tried, in any ground tolerably fertile, the produce is hardly to be credited.

The propriety of cultivating rye-grass, is an important subject of discussion. Mr Arthur Young informs me, that the English farmers, who are eminent in their business, abhor rye-grass on strong lands, from a multitude of observations on the wheat which follows it, for the cases are many, in which fields, partly sown with clover alone, and partly with clover and rye-grass, where the superiority of the wheat after the clover alone, induced them to resolve on the omission of rye-grass in future. He adds, that cocksfoot answers all the pur-

teen years, yielding good crops, and perhaps may remain in vigour much longer. He has tried transplantation, and it answers to his wish, for lucern throws out a number of fresh shoots from its root. It requires to be hoed clean from any other grass or weeds. There cannot be a doubt of its thriving well in Scotland, in rich deep soils, which it requires, as its shoots go far into the ground; hence a tilly or rocky bottom is improper for it.

poses of rye-grass, particularly as a mixture with clover, supports more stock, and does not equally exhaust. In regard to rye-grass, either cut green, or converted into hay, a person of much experience in the management of horses, (Mr Alexander Maclaurin of Edinburgh), considers rye-grass mixed with clover, as a strong, pleasant and substantial food for horses even at hard work, and every season he has given it green, even to post-horses, in the stable, and it has answered well. He is also of opinion, that hay made of clover and rye-grass, if cut at a proper season, (before the plants are too ripe,) if safely got in, and properly thatched, so as to prevent it from the winter rains, instead of becoming dry and husky, as some people imagine, improves by time, and is much fitter for the use and benefit of horses, than if used some months before, and indeed will retain this perfection all the ensuing summer, autumn, and next winter; on the supposition, always, that it is preserved from rain. Good old hay, for that reason, always gives a higher price than new. In a comparative view of rye-grass, mixed with clover, and meadow hay, the former is to be accounted far preferable to the other, on account of its strength and substance, by which horses are enabled the better to stand hard work. The fibres of meadow-hay are soft and small, and according to Mr Maclaurin's opinion, dissolve sooner in a horse's stomach, consequently not so proper for hard-working horses as the other. If cocksfoot, however, would answer all the purposes of rye-grass, without exhausting the land, what an advantage?

The cultivation of artificial grasses in Scotland, is already so generally known, and will be so fully detailed, in the General Report now drawing up, of the Husbandry of Scotland, that it does not seem necessary to dwell upon it longer in this place. We shall proceed, there-

fore, to consider how far the crops above enumerated, ought to be sown broadcast, or drilled.

Hints as to Drilling.

It has long been a subject of dispute, whether it is most advisable to sow the different crops usually cultivated on arable land, drilled or broadcast. Without entering into so wide a controversy, I shall endeavour shortly to state the opinions entertained by the intelligent farmers, with whom I have lately corresponded, on the subject of Scottish Husbandry.

It seems to be universally admitted, that it is the most advantageous system, to drill turnips and potatoes, and that drilling, in regard to these articles, is greatly preferable to the broadcast mode, for the following reasons :

1. As it carries off the extra moisture in wet soils : 2. As it exposes more surface to atmospheric influence, by which the soil is meliorated ; and, 3. As it gives an additional opportunity for the vegetation and the destruction of weeds *.

It would appear likewise, from the experiments of Mr Butterworth and others, that drilling carrots is an advantageous system, as the plant can thus be cultivated on soils, where otherwise it would hardly be practicable, the drills furnishing an artificial depth of soil in which they can be raised.

* Remarks by Captain John Henderson of Ainslie in Caithness. Some prefer turnips broad cast, imagining that they are better protected from the frost, by the earth, than when raised in ridges ; in which case the earth is apt to fall from them.

Many also approve of the system of drilling beans, as the pods of beans are placed on the stem from the root upward, and of course derive essential benefit, when filling, from the open space left between the drills. This is admitted on light or loamy lands; but where the soil is of a strong and clayey nature, the broadcast system is frequently preferred, more especially in the Carse of Gowrie, as in a rainy season it is found very difficult to perform the necessary drilling operations in clay, which renders the crop uncertain and precarious, and not a cleaning one*.

Many farmers also drill their pease, more especially in light and pliable lands; but on strong clays, it is said that pease broadcast succeed better. It is remarked by Mr Stuart of Hillhead, that pease sown in drills may be calculated for cleaning the land, but not for obtaining a crop; and Mr Charles Alexander observes, that he has several times attempted the drilling of pease, but never with success; the slender nature of that plant not admitting of horse-hoeing, except when young; and as it is not of upright growth, not well then. As that plant supports itself by the plants taking hold of one another, the interstices prevent the tendrils from getting hold, except in the row, when the wind blowing across the drills lays them over on one side, and retards their podding.

In regard to white crops, some eminent farmers, Mr Brown of Markle in particular, consider the advantages of that system to be at best but problematical†. The intelligent farmers, however, in the

* Observations by Mr Peter Jack of Moncur.

† One of my correspondents remarks, that in regard to the drilling of white or culmiferous crops, he has had no ex-

neighbourhood of Dunbar, whose lands are subject to annual weeds, and who sow a great deal of wheat in spring, have adopted the drilling system with much success, and consider it essential for the culture of their land.

Some experiments made by Mr Hope of Fenton, East Lothian, are among the most satisfactory and decisive I have met with, on the subject of drilling. From these experiments, he is inclined to draw the following conclusions: 1. That it is of no advantage to drill winter sown wheat, as the crop is never injured by annual weeds, and where the soil is infested with root weeds, as the crop, in ordinary cases, will completely meet in the rows, before the root weeds make much appearance, it is impossible, without injuring the crop, to render much benefit to the land with the hoe. 2. On all land, however, where annual weeds are abundant, he considers it of great importance, to use the drill for sowing white crops of every description, it being understood at the time, that plenty of hands can at all times be obtained for using the hoe; for it is better to sow in the common method broadcast, than drill without hoeing.

Mr Hope adds, that an experiment was tried in his neighbourhood, which places the advantage of drilling in a very favourable point of view. A field of grass land, of good quality, which, in consequence of having been always cultivated in the broadcast manner, was full of annuals, was all drilled, with the exception of six ridges in different parts of the field, which were sown broad-

perience; but it appears to him that the operation is tedious and minute, without any adequate benefit. The drilling of these can never be meant for cleaning the ground; a very good farmer will have it clean before they are sown in it. It is not so easy, however, to get the better of annual weeds.

cast, that the difference of produce between the two might be ascertained. The drills were made at a foot distance between the rows, and the drilled part of the field was hand-hoed, during the summer, at the expence of one guinea *per* acre *. The difference of produce was very great, for the broadcast yielded only 9 bolls *per* Scotch acre, whereas not less than 15 bolls was the produce of the other.

Among the advantages of drilling, Mr Hope states, that he has uniformly found the expence of cutting a drilled crop in harvest less than what was sown broadcast; the difference he has always found to be in this proportion, that three reapers will do as much work in the former case as four in the latter.

Mr Church of Hitchel recommends drilling wheat crops, not only for the purpose of having an opportunity to eradicate weeds by hoeing, but to give the grain a good hold of the ground, which may prevent the frost throwing it so easily out in the spring, and the wind loosening the roots of it so readily when it is in ear and beginning to fill. On light land, he has sometimes observed the grain make no farther progress towards perfection, after a high wind at this period, which he presumes is owing principally to the roots being loosened, the ascension of nutriment to the ear being thereby prevented.

* Mr Scott of Craiglockhart recommends the Dutch hoe as the best, for the operator proceeds backward, leaving the wrought ground and cut weeds untrod: the work is also much lighter, as less force is requisite, and stooping unnecessary. If taken in time, before the weeds get rough, a girl will hoe with ease the fourth part of a Scotch acre *per* day.

Mr Robertson of Ladykirk is of opinion, that the propriety of drilling turnips, beans and potatoes, cannot be doubted, and that the more labour and hoeing bestowed on the crops, with judgment, and in dry weather, the better will be the returns. He has also observed, that drilled crops are less apt to be beat down in wet seasons.

It is remarked, from the highest authority in the Carse of Gowrie, that the culture of white corn crops by the drill, might be a beneficial mode of husbandry in that valuable district, as it would be the means of extirpating the growth of annual weeds, which are so destructive to the spring crops in the Carse, particularly the beans, the pease, and the oats sown early upon well frosted land, which are often rendered not half a crop by the growth of wild mustard.

An intelligent farmer near Arbroath, (Mr Rennie of Kinblethmont), states it as his opinion, that the drill system ought to be adopted, wherever turnips, potatoes, beans, or even pease, are sown; the intervals not less than twenty-seven inches, regularly horse-hoed, and the rows hand-weeded by women; which, if properly executed, leaves the ground in as good order as if it had undergone a naked fallow. None of the above-mentioned crops can be cultivated to advantage broadcast; for in case of its failure, the ground is sure to be left in a wretched state indeed. In case of the soil being light, and much infested with annual weeds, the drill system may with great propriety be adopted with wheat, barley, and oats; but in that case the intervals should not exceed nine inches, to be either hand-hoed, or done with a machine made for the purpose. The seed to be deposited by a sowing-machine, and the grass-seeds co-

vered in with the last hoeing, which answers perfectly well.

The following, on the whole, seems to be the result that may be drawn from this important discussion.

1. That turnips and potatoes ought to be drilled in all cases.

2. That drilling carrots is advisable, more especially where there is not a great depth of soil.

3. That beans should be drilled on light and loamy soils, but not on very harsh, strong, and stubborn clays.

4. That pease may be drilled in dry soils and climates, where the object is to clean the land; but where the land is clean, sowing broadcast suits better the nature of that plant.

5. That autumn or winter sown wheat may be cultivated broadcast, but that spring sown crops, whether wheat, barley or oats, are most likely to be productive, where annual weeds abound, when cultivated in drills.

It may be proper at the same time to observe, that in several districts in England, particularly in some parts of Norfolk, and Suffolk, they carry their ideas in favour of the drilling system, in so far as regards crops of grain, still farther.

8.—ROTATION OF CROPS.

Of all the subjects included in the present inquiry, this, perhaps, is the most important, and the most difficult to discuss*. The returns transmitted to me regarding this single point, exceed eighty in number, and would form a moderate volume. It is my duty to en-

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* Even in gardening a rotation of crops is advisable. See Nicol's Gardener's Kalendat, p. 21.

deavour to compress this mass of useful information, within a moderate compass. With that view, I shall endeavour briefly to point out the best modes of cropping suggested in the course of the inquiry. It must depend upon the judgment of the farmer, to adopt those which are best suited to the climate where he resides, the nature of the soil he cultivates, the size and situation of his farm, and a variety of other circumstances which will necessarily require his attention, in determining which ought to be preferred *.

Every farmer must be aware, in fixing on his rotations, that it is necessary for him to ascertain, not only the various articles for the production of which his farm is calculated and which are likely to yield him the greatest profit; but also the succession in which these articles ought to be raised, so as not to diminish the fertility of his soil; or, as Lord Kames has well observed, so to intermix his crops, as to make the greatest possible profit, consistently with keeping his land in order.

The subject of judicious rotations, has been very ably touched upon in one of the first reports drawn up for the Board of Agriculture, (that of Huntingdonshire), by Mr Maxwell of Fletton. That intelligent farmer having suggested a course of crops, the propriety of which will be afterwards discussed, very justly remarks, that after all the volumes that have been written on farming, a *rational system* is the only true groundwork of general

* Mr Church of Hitchel, remarks, that to adopt a judicious mode of cropping, requires a degree of judgment in the occupier, which can only be obtained by experience and observation. Much depends, however, on the manner in which the different processes are executed. The best arranged rotation may be of little use, if these are done improperly.

improvement, and that those who carry into execution a profitable system of management, bid fair to engage the notice of the neighbourhood, in spite of the impression of those habits which attach to unlettered farmers, and thus may be the source of essential service, both to the cause of agriculture and to their country.

On this part of the subject it may be sufficient to add, that almost the same crops, which, under one system, would be extremely unprofitable to the farmer, and injurious to his land, under another rotation, with an intervening crop or fallow, might be not only profitable, but might promote its fertility*.

In considering this important subject, it is proposed shortly to discuss the following particulars: 1. The principles or maxims on which rotations ought to be arranged: 2. The various sorts of rotations which have been adopted in Scotland, for various periods of two, three, four, five, or for a longer period of years: 3. Of double rotations, where two systems are in a manner carried on at the same time: and, 4. Any miscellaneous particulars connected with this branch of the inquiry.

1. Of the principles on which Rotations ought to be arranged.

I have endeavoured, in the preceding section, to point out the various articles which are principally cultivated in Scotland. These articles must be raised, either con-

* Compare, for instance, the old course in the Carse of Gowrie. 1. Wheat. 2. Barley. 3. Oats. 4. Pease and beans, when the crops were trifling, with the new system. 1. Fallow. 2. Wheat. 3. Beans. 4. Barley. 5. Grass. 6. Oats. Under the first course, the rent was only from 25 s. to 30 s. *per* acre. Under the second, it has in many cases risen to L. 5 or L. 6 *per* acre, and upwards.

stantly on the same ground, or one year must be appropriated for the growth of one sort, and the next for the production of another. There are few cases where the same land will constantly yield one and the same plant, or where a repetition of the same crop, or indeed of the same species of grain, without some interval, is not found to be injurious. Hemp is the principal exception to that general rule; for in Russia, the same ground invariably produces it, without either fallow or any intermixture of crops. It appears from Mr Butterworth's experiments already mentioned, that carrots have been successfully cultivated for seven years, on the same ground, with increasing fertility. In some instances, bear or big, has been sown for years on the same ground. But in general, a change or rotation of crops, has been found not only expedient, but necessary.

The propriety of adopting any rotation must depend on a variety of circumstances, more especially the following. 1. *On the climate*, Whether it is wet or dry. Wet climates, for instance, are favourable to the production of potatoes and oats, dry climates for pease and beans; and the rotations to be adopted in each climate ought to be formed accordingly. 2. *On the soil*; for clay, loam, or sand, have each various crops best calculated for them. 3. A rotation must also depend *upon the situation of a farm*, in regard to the probable sale of its productions: for instance, a large field of potatoes, which might be worth L. 25 per acre, near a great town, might not be worth L. 5, in a remote part of the country*. 4. *On the means of improvement by extra manure*,

* That able reporter, Mr Kerr, in his account of the Berwickshire husbandry, remarks, that unless near large towns, where potatoes are substituted for fallow or turnips, they never constitute a complete part of any rotation, because un-

as lime, marl, sea-ware, town dung, &c.—The celebrated Dunbar rotation, of, 1. Turnips; 2. Wheat; 3. Grass; and, 4. Wheat, could not be possibly carried on, without the command of sea-ware, which that neighbourhood possesses: and, 5. The rotation must also depend *on the state or condition of the soil*, whether it be old cultivated land, or a new improvement.

We shall now proceed to state the maxims, which have been recommended, as the best calculated, to lay the foundations of judicious systems of rotation.

1. It is proper to have *various articles on your farm*, so as not to run too much risk, either in regard to the season, or to the sale of the produce afterwards. If a farmer were to cultivate but one crop, he might often be materially injured by one unfavourable season; or if the article which he raised was not saleable, the land had better have remained unploughed.

2. To have the crops so arranged, that the labour of ploughing for each, of sowing, weeding, reaping, &c. shall proceed in a regular succession, and that the labour or business be not too much crowded on the farmer, at any one season of the year, nor any extra stock rendered necessary; but that the crops produced on the farm, shall be cultivated by the same hands, and with the same cattle. To this general rule, hand-hoers in spring and summer, and reapers in autumn, must form an exception.

3. To avoid forcing crops, or frequent repetitions of the same articles or species, a diminution both in quan-

saleable, unless at prices inferior to their cultivation, and if universal, or even but a little more extended, they would be unsaleable almost at any price. Berwickshire Report, p. 214.

tity and quality, except in very rare instances, never fails to be the consequence. By frequent repetitions of the same crops, (as Mr Scott of Craiglockhart remarks), the soil loses stamina, which neither manure nor cultivation can renovate. Great luxuriance in vegetation can be made to take place, without much real productiveness, as we see where grain is sown on the sites of dunghills*.

4. To avoid two white crops in succession, but alternately to have white and green crops. To this general rule there is an exception, when old leys are broken up, in which case, two crops of oats ought always to be taken, the second crop being uniformly the best. On this head, an intelligent farmer in Berwickshire observes, that it is impossible to lay down general rules, without modifying them by such circumstances as are often only to be known by real practitioners: and though the system of alternate green and corn crops, is, beyond question, an excellent one in general, deviations from it may sometimes be admitted.

5. To avoid crops likely to encourage weeds; and, founded on this principle, Lord Kames objects to the culture of pease, which, if not an extraordinary crop, are apt to foster weeds. If the land has been previously fallowed for wheat, and thus cleared of weeds, pease, after wheat, he thinks, may be hazarded †.

* Mr Andrew of Tillilumb, near Perth, finds, that if clover is cultivated only once in eight years, the produce is not only about double, but that the succeeding crop of oats is better by two bolls *per* acre. In regard to crops of wheat, Mr Pringle of Ballencrief, in East Lothian, remarks, that he does not observe the crops of that grain falling off, though they are more frequently introduced than formerly; in many instances, once in three years.

† Gentleman Farmer, p. 143.

6. To raise those crops the most likely to be productive of manure; hence green crops are to be recommended, and barley is to be avoided, producing, when compared to other crops, the smallest quantity of straw*.

7. To arrange the crops so as to keep the land in good condition, and increasing, rather than diminishing in point of fertility†. This is best accomplished by the convertible husbandry, (or white and green crops in succession), and giving every part of a farm the advantage of being occasionally pastured.

8. To commence a lease with a meliorating system, but during the remainder of the term, to crop the land in such a manner, as to reap, *in moderation*, the advantage of the improvement that has been made. In forming a rotation, therefore, those articles should be included, which are the most likely to afford a profitable return to the farmer.

Keeping these maxims in view, we shall now proceed to consider, the various rotations which have either been adopted by, or recommended to, the attention of the farmers in Scotland.

* A fair average of straw produced by the different crops, according to Mr Brown of Markle's calculation, is, Wheat, 160 stone; Beans and pease, 130; Oats, 120; and, Barley, only 100, *per* Scotch acre.

† Mr Andrew of Tillilumb justly remarks, that it ought to be a leading maxim with all farmers, never to take a crop but when their ground is in such situation that, if the season favours, it may give as good a crop as such land will carry. Hence their first care and chief study ought to be, how they may bring their ground into, and keep it in the best order, and not what they can *draw* or *take*; for if they are kind and generous, the grateful earth certainly will *give*.

2. *Of the various sorts of Rotations.*

It is not unusual, in treating of this part of the subject, to consider rotations as they are applicable to different soils, for instance, clay, loam, &c.; but I think it on the whole more expedient, to discuss the different courses of crops, according to the number of years they respectively require to finish the rotation; some occupying two years, some three, some four, some five, &c. Under each head it will be proper to explain, for what description of soil each rotation is best calculated.

Two years Rotation.

In particular cases, some farmers have adopted a rotation of two crops. A field belonging to the Honourable George Abercromby, embanked from the Forth, carried, for several years, beans and wheat alternately. Upon his best loams, Mr Brown of Markle also, takes wheat and beans alternately, summer-fallowing the ground, when its condition requires that process. Mr Fairie of Farme, near Glasgow, has adopted the same system, giving a moderate dressing of dung every fourth year. Dr Charles Stuart, on his farm near Edinburgh, has tried a similar system on four acres and a half of loam, the rotation being wheat and green crops alternately; but the latter were alternate potatoes and beans, both drilled. In the course of fourteen years, he has had, on this field, four crops of potatoes, three of beans, and seven of wheat. To every green crop, putrescent manure was applied; thirty tons at least to potatoes, and twenty-five to beans. The potato crops were all good: The two first crops of beans were very good: The third, indifferent. The crops of wheat were large, pro-

ducing from ten to thirteen bolls, Linlithgow measure, *per* Scotch acre. The only deficiency was in crop 1789, which averaged but nine bolls *per* acre; that might be ascribed, however, to a season peculiarly unfavourable. There is no evidence of diminished fertility in the field, for it is now, (August 1810), covered with a luxuriant crop of turnips. It is perfectly free from couch-grass, and rooted perennial weeds, which are now in a great measure extirpated by hoeing and weeding, but it is still much infested with annual weeds, particularly the wild mustard and radish, which may be imputed to the neglect of the farmers in the neighbourhood, and to the use of Edinburgh dung, stored with the seeds of these and other injurious plants, which the richness of the soil brings both speedily and universally to vegetate. Dr Stuart adds, that the quantity of produce from the above rotation has not diminished, but that both the wheat and beans have at least degenerated in quality, and on this account, though the result might not be thought unfavourable by many, he would not adopt it, if he had a larger space of land on his farm calculated for wheat.

It is evident, that it is only in the richest loams, and most fertile soils, that such a rotation is at all practicable.

Three years Rotation.

We shall next proceed to consider rotations of *three crops*.

Mr Arbuthnot, whom Mr Arthur Young considers to be the ablest farmer he ever knew in the course of his long experience, practised, for nine years, a three course system, viz. 1. Beans; 2. Wheat; 3. Clover, and when he quitted the farm where that plan was adopted, he was fully persuaded, that he could have continued that rotation for many years longer. This, however, was effected by means of London dung, which he had at

command, and which he gave to the bean crop. He also ploughed nine inches deep, with a plough, which Mr Young denominates the best tool ever invented *.

Others have also followed a similar system; for instance, 1. Potatoes, cabbages, or hoed crops, with manure; 2. Wheat; and, 3. Clover or grass: Or, 1. Hoed crop, with manure; 2. Half oats, and half barley; 3. Clover or grass.

Dr Coventry has made some observations upon these courses, to which he urges the following objections.

1. That there is rather too large a proportion of fallow or cleansing crop, more than what can be wanted in ordinary situations, to preserve the land free of weeds.
2. By there being but one-third bearing corn, it is less profitable than it might be.
3. There are two species of crops in the first example; which circumstance does not permit the labour to be sufficiently divided and extended over the year, and leaves too much to be risked on the success of a particular crop.
4. The quantity of straw obtained for food or litter, to live stock, must be rather scanty, or in a deficient proportion to what will in general be wanted.

The advantages of such a system, he states, in the following terms. 1. From the great proportion of green crops in this course, much manure will be procured, somewhat more, perhaps, than may be necessary. 2. This scheme is calculated to render or preserve the land very clean of weeds. It may therefore answer as a beginning course, in situations where the ground is foul,

* Mr Young proposes drawing up for the Board of Agriculture, an account of this eminent farmer; to which he intends to add the lives of Bakewell and of Duckett.

and manure wanted; but it may be relinquished afterwards for a better one. It is not indeed in general use in any district, and has only been followed by some individuals, who have found it of benefit in the respects above mentioned.

Four years Rotation.

Rotations of *four crops*, however, are by far more general, and will require more ample discussion. The first to be pointed out, is the celebrated Norfolk system, namely, 1. Turnips; 2. Barley; 3. Clover; and, 4. Wheat. Even in Norfolk, however, this course is no longer so generally recommended. It is considered prejudicial to the landlord; and, on a lease of twenty-one years, if constantly persevered in, it is contended, would not be found profitable to the tenant. Half the farm has annually a white straw crop, which, from the frequency of the repetition, would not be productive; besides which, the number of sheep and cattle kept under this system is comparatively trifling*.

It may be proper to compare this rotation, with others on a similar principle, for dry soils.

In Roxburghshire, Mr Walker of Mellendean's rotation is $\frac{1}{4}$ in turnip and drilled beans; $\frac{1}{4}$ in wheat and barley after turnips and beans, and sown down with grass-seeds; $\frac{1}{4}$ in hay, soiling, and pasture-grass; and $\frac{1}{4}$ in wheat or oats, after hay and pasture. In the light soils of Norfolk, neither beans or oats are cultivated.

* See a communication on this subject from Mr Money Hill, Esq; of Waterden to the author. Dr Coventry remarks, on the Norfolk system, that though the land on which this scheme is pursued, seldom, if ever, becomes by it less fertile, yet for poor ground it seems not to be sufficiently melio-

Mr Rennie of Fantassie, and Mr Brown of Markle, generally adopt, in their turnip soils, the following rotation: 1. Turnips; 2. Winter wheat, sown in spring *, or barley; 3. Clover; and, 4. Oats. This is certainly a productive rotation, and it is strongly in its favour that it is recommended by such eminent farmers, who are justly accounted at the head of their profession.

Mr Hunter of Tynefield's rotation is, 1. Turnips; 2. Wheat; 3. Grass, (mostly sheep fed), 4. Four-fifths winter wheat sown in spring, and one-fifth oats. He adds, that under this rotation, the produce of his farm has been improved, both in quality and in quantity, since its commencement to the present time, *and continues to improve*. The additional quantity is to the amount of no less than $1\frac{1}{2}$ boll *per acre*.

I have now to state a course of cropping still more severe, which I think may be called *the Dunbar Rotation*, as hitherto it has only prevailed in that neighbourhood. The course is, 1. Turnips; 2. Drilled wheat;

rating, or fitted soon to raise land to that degree of productiveness, in which it is found to be the most valuable to the cultivator.

* In regard to winter wheat sown in spring, *after turnips*, an experienced farmer, (Mr Dudgeon of Prora), observes, that it may be safely sown as late as the middle of March, and has succeeded even later, and that on fine land it may be safely taken in preference either to barley or oats, if sheep have eat the turnips upon the ground. This is the most valuable, and the least expensive method of using them. But fine land, by this scheme, would be over-dunged, were it not for the practice adopted of stripping out a part of the turnips, to the amount of one fourth, one third, or even one half, (leaving the alternate rows), and carrying those drawn out to the cattle. When a certain breadth is thus stripped, the sheep-flakes can be set upon the drills which remain, and the stripping be carried on, as they need more ground.

3. Clover ; 4. Drilled wheat. Being extremely anxious to ascertain, not only the details of this system, but also whether the plan, when persevered in, continued to be productive, I procured the following particulars regarding it, from Mr Hume of East Barns, and Mr Rennie of Oxwell Mains, two respectable farmers, by whom it is adopted. They informed me, that some deviations were occasionally made from the plan, (but not such as to alter the general system), by cultivating, on rich spots, pease, or beans, or potatoes, in lieu of turnips, and by having three green crops in succession, when the soil is much subjected to the growth of annual weeds, or requires to be refreshed. It would appear, however, that without a good climate, such as they enjoy in the lower part of East-Lothian, and great quantities of sea-ware, or other adventitious manure, it would be impossible to continue such a rotation. The quantity and sorts of dung usually applied, is, to the amount of about thirty double horse cart-loads *per* Scotch acre, to the land intended for turnips. The turnips are always eaten on the ground by sheep, which is, (where the situation will admit of it), by far the best and cheapest method. The same quantity of dung or sea-weed, is also applied on the grass land before ploughing. It is found, that applying the sea-weed early in spring, on the clover to be cut, if laid on in dry weather, answers well for the succeeding crop of wheat.

The soil where this rotation prevails, is of a dry quality. If such a rotation were attempted on wet soils, it would be advisable to sow oats after the grass, instead of wheat *, (and that is in general the preferable system),

* Upon the trial of a small piece of grass, partly wheat, and partly oats, both close together, Mr Dudgeon of Prora actually had thirteen bolls of oats, and only seven of wheat

but in land of a very dry quality, the drought is frequently very prejudicial to the crop of oats, which require moisture, and consequently should be sown early in dry soils and climates.

per acre. It may be proper to explain the circumstances as they really stood. Upon entering to a field of three year old grass, he was urged to sow it with wheat in the spring, but declined to adopt such a scheme, as having something in it to him *quite novel*. He was induced, therefore, by the advice of an eminent agriculturist in East Lothian, who much disapproved of the wheat scheme, to make the above trial. When told the result, and when asked, if wheat would do much better after one crop of clover, though it might alter the case a little, he gave a decided opinion in favour of oats, even in that case. What induced some to approve of wheat upon old grass after pasture, in this case, was, the superior excellence of the soil, and its uncommon tenderness. The wheat and oats were both sown near the middle of February, both equally well harrowed, and covered with the mould; but the former, besides being deficient in quantity, was much inferior to good wheat, while other spring-sown wheat, on such land, but not sown after pasture, was as fine as usual.

Other intelligent farmers, also, object to wheat after grass. Mr Andrew of Tillilumb, near Perth, states, that if only one ploughing is given to wheat after grass, the slug-snail eats it up. This is also partly the case, though it gets several ploughings, unless they are given very early in the season, as thus he apprehends the ground does not yet get time to rot and pulverize, so as to gather that firmness and closeness which would prevent their lodging therein; and besides, he thinks that there is a *something* about the ground after grass, which is not congenial to wheat: hence, though the snail may not devour it about this time or in winter, it dies away in the spring, or blights in summer.

Another farmer remarks, that he sometimes sows a few acres of wheat, by preparing it with rag-fallow; that is, by giving the ley two or three furrows, and proper harrowings, to reduce the turf. However, if the loss of winter pasture, extra work beyond what an oat-crop requires, and the foul state the land is commonly left in, by this practice for fallow, is put to the debtor side of the wheat account, perhaps this method of growing wheat, does not prove more profitable than an oat crop. He has tried, he adds, wheat after grass, but never found it answer with only one furrow.

The principal objection to this system, according to Dr Coventry, is, that too much labour comes to be performed at one period of the year, and that too much is risked, or left dependent on the success of a single species of crop.

One most important observation on this subject has been made by Mr Rennie of Oxwell Mains, namely, that wheat sown after grass, early in autumn, often fails; but if sown in spring, it generally succeeds. It is never at the same time so good in quality, or so productive in quantity, as wheat after turnips, or even after pease and beans*.

Mr Hume of East Barns observes, that it is more in the rotation, than in the mode of ploughing, that most farmers are deficient. He is convinced from experience, that pease are not calculated for East-Lothian to any extent: if his lands therefore were unfit to carry beans, and were dry enough for turnips, he would consider the four-course shift of 1. Turnips; 2. Oats, Barley, or Wheat; 3. Grass, and 4. Oats, as the best mode; and if the farm were so situated, as not to be able to give a thin dunging every fourth year, in the turnip drills, in that case let the grass remain two, or even three years old, so as

* It would be well worth while for some English farmers to try winter wheat, accustomed to be sown in spring, on their clover leys, particularly where any failure in their winter sown crops had taken place. The best plan would be, to sow turnips early on the clover ley, to eat them off with sheep in spring, and then to sow winter wheat. The dung of the sheep, would occasion rapid vegetation. There would be no risk from the frost, or the wire-worm, which last the treading of the sheep, with perhaps some young cattle, would effectually destroy, and the land would be in excellent order for the production of wheat. This plan, if it succeeded, would render this country at once independent of foreign nations for bread corn.

to require a fifth or sixth part annually dunged. If the lands were clay, consequently unfit for turnips, he would take fallow, wheat, grass, and oats; the grass to remain one, two, or three years, as above. The grass, after the first year, would pay little on clay lands, but when in grass, there is no expence, and all the other crops must be good; but on land that will carry beans, he thinks, the six-course shift the best, viz. 1. Turnips, or Fallow; 2. Oats, Barley, or Wheat; 3. Grass; 4. Oats; 5. Beans; and 6. Wheat. This, on its proper soil, he considers as the best mode of the whole, consequently such lands are able to pay the highest rent.

Another rotation of four crops is adopted in Ayrshire, namely, 1. Fallow, or Fallow Crops; 2. Wheat; 3. Clover; 4. Oats; and by adopting that rotation, an active and intelligent farmer, (John Tennant, Esq; of Girvan Mains), has gradually been enabled to stock three different farms; and beginning with a rent of only L. 50 *per annum*, he now annually pays L. 2700, or *fifty-four times* the sum he originally paid when he commenced his professional business. There can hardly be a stronger argument in favour of that system.

Mr Brodie of Garvald, in an upland farm, where the fixing of a proper rotation, is of peculiar importance, adopts the following course. 1. Turnips; 2. Barley; 3. Grass; 4. Oats. He recommends the red oat in particular for such situations, and in the more northern or higher situations and districts, it is probable that bear or big would be better than barley.

The rotation of four crops adopted near Edinburgh, namely, 1. Potatoes; 2. Wheat; 3. Clover; 4. Oats, is unfortunately only calculated for the neighbourhood of great towns.

There cannot be a better preparation for wheat than potatoes, nor one more valuable, in respect of produce,

but they require a great quantity of dung, and are not always marketable.

We shall now proceed to state rotations of four in clayey soils.

In thin clays, a four course shift is the best ; as, 1. Fallow ; 2. Bear or Barley ; 3. Clover ; and 4. Oats ; because such soils, the longer they remain in grass, the worse they become.

On the estate of Monorgan, in the Carse of Gowrie, the following rotation was adopted on a fine friable dry clay, and has been for many years followed with much success : 1. Fallow ; 2. Wheat ; 3. Drilled Beans ; and, 4. Wheat.

A farmer, who has taken about 300 acres in that district, at the rent of about L. 6, 10 s. *per* Scotch acre, proposes, I am informed, to adopt the following course, and expects to derive from it, at a moderate calculation, the following produce and value :

Year.	Crop.	Produce.	Price.	Value.
1	Beans,	11 bolls,	28 s.	L. 15 8 0
2	Wheat,	11 bolls,	35 s.	19 5 0
3	Hay,	300 stones,	9 d.	11 5 0
4	Wheat,	10 bolls,	35 s.	17 10 0
				4) L. 63 8 0
Average <i>per</i> acre <i>per</i> annum,				L. 15 17 0

This sum might be divided in the following manner :

1. Two-fifths for seed and labour,	-	L. 6 6 9 $\frac{1}{2}$
2. Two-fifths for rent,	-	6 6 9 $\frac{1}{2}$
3. One-fifth for tenants' profit, interest of capital, &c.	-	3 3 5
		L. 15 17 2

There is certainly a risk that the above rotation will not keep the land sufficiently clean, on which account it might be advisable, to drill the crops of wheat, and perhaps, instead of wheat, to sow oats after clover.

Five years Rotation.

Rotations of *five crops* have in many cases been recommended both for strong and light lands.

Above forty-two years ago, John Mackenzie, Esq; of Glasgow, adopted the following system : 1. Potatoes ; 2. Wheat ; 3. Grass ; 4. Pasture ; 5. Oats ;—a plan which he observes, has not yet been improved upon, except by keeping a greater number of cows for the dairy. On the subject of cropping, Mr Mackenzie makes the following important observation. Whenever the farmer discovers that he can be as well paid by cultivating for the use of cattle as for man, and whenever Britain serves herself in butchers' meat, butter and cheese, she will cease to find it necessary to import grain. It is an unimportant question to discuss, whether an acre will support more of the human species by grain, or by animal food. The nation which lives most on animal food, will, under a proper system, have more grain than those who live mostly upon it ; this is caused by the increase of manure. Grain, he adds, should never be sown, but when laying down to grass or ploughing from it.

Mr Boyd of Powis, near Stirling, prefers the following rotation on a strong carse soil, and he has followed it with much success, for some years past : 1. Fallow ; 2. Wheat ; 3. Hay ; 4. Oats ; 5. Beans.

On dry black land, if there is the command of a sufficiency of dung, the following rotation of cropping, is recommended by Mr Drummond of West Bank, in the

parish of Longforgan, namely, 1. Grass; 2. Wheat; 3. Barley; 4. Green crop; 5. Oats.

On light soils of moderate quality, a five field course is recommended by that intelligent farmer Mr Alexander, viz. 1. Turnips; 2. Grain; 3. Grass; 4. Grass; 5. Grain.

Upon moss or peaty soils, after effectual draining, the following course is recommended: 1. Potatoes or turnips; 2. Barley or Bear; 3. Clover; 4. Pasture; and, 5. Potato Oats, a most advantageous crop.

Mr Maxwell of Fletton, in his Report of Huntingdonshire, considers the following course of crops for five years, as preferable to every other. 1. A cleansing crop of whatever kind is best suited to the soil, as turnips, tares, or cole-seed, to be hoed, but not to stand for seed; 2. A crop of white corn of the kind best suited to the soil, to be laid down with clover; 3. Clover, either grazed or mowed; 4. Beans, sheep-fed and hoed, or some such meliorating crop adapted to the soil; 5. White corn suited to the soil: and he contends, that however various our soils, and however different in their nature, the same order or course of cropping ought to be pursued, (fen lands always excepted), changing only the species of our corn and vegetables, and adapting them to the nature of the soil we have to work upon.

It is certain, that by such state of cropping, a soil of tolerable natural fertility, might not only be supported without foreign aid, but might increase in fertility; but Dr Coventry on this subject has well observed, that when crops, *intended to ripen their seed*, are objects of culture, there is only wanted a degree of vigour and luxuriance in the plants, sufficient for that purpose; and if the fertility of the soil be raised to a higher pitch

than is necessary, or consistent with that object, injurious, rather than beneficial effects, may be the consequence. Land may be too rich for corn crops, and it is better to keep it in a *well balanced condition*, or in a medium state of productiveness, than in too fertile a condition; besides the climate may be unfavourable for pulse crops, in which case a second year of herbage would be preferable to beans or pease.

It is proper now to state, the improved systems of cropping in Norfolk, a district from which Scotland has derived so much valuable information. The courses, as recommended by that eminent agriculturist Mr Coke, consist either of five or six crops. The five course is, 1. Wheat; 2. Turnips; 3. Barley; 4. Clover; 5. Grass. The six course is, 1. Pease; 2. Wheat; 3. Turnips; 4. Barley; 5. Clover; 6. Grass.

It is now ascertained, that for a district possessing a soil and climate similar to that in the neighbourhood of Holkham, the alternate use of the five and six course system, is the best husbandry, because pease will not succeed more than once in ten years.

We shall now proceed to consider the rotations of *six crops* adopted in Scotland, where it is a favourite system.

Six years Rotation.

In a light soil near Alloa, Mr Kerr of Lorne's Hill has adopted the following rotation: 1. One half potatoes, one-half turnips; 2. One-half wheat after potatoes, one-half oats after turnips; 3. Hay; 4. Pasture; 5. Oats; 6. Barley.

Mr Robertson of Ladykirk proposes the following rotations on a good soil, 1. Potatoes or turnips; 2. Barley; 3. Grass; 4. Potato oats; 5. Beans; 6. Wheat.

On inferior soils, 1. Turnips or fallow; 2. Wheat; 3. Clover; 4. Pasture; 5. Pasture; 6. Angus oats.

On all the strong lands in the Carse of Gowrie, and in other fertile districts in Scotland, the following rotation of six crops, with some variations, is considered as preferable to every other. 1. Fallow; 2. Wheat; 3. Beans; 4. Barley; 5. Grass; 6. Oats; and indeed if it is admitted, that fallow is necessary once in six years, there cannot, on the whole, be a better system, for strong or rich soils. Where wheat can be taken the fourth year instead of barley, the produce is still more valuable. By some farmers, the course is altered in the following manner: 1. Fallow; 2. Wheat; 3. Clover; 4. Oats; 5. Beans; 6. Wheat.

Since the decrease of the value of barley, and the great demand for wheat, they have, in the Carse of Gowrie, in some degree, deviated from the regular system above pointed out, by sowing about one-half of the fourth division with wheat and with grass-seeds, to bring the grounds again into a proper rotation, in order that the whole fifth division may be under grass; and still farther to increase the quantity of wheat, a great part of the sixth division is often sown with wheat instead of oats. By thus stealing from the barley and oat divisions, which is done *only in favourable seasons*, there is often one-third part of the farm in wheat, instead of one-sixth part, as the rotation before points out.

On the subject of this rotation, it is only necessary to add, that some intelligent farmers disapprove much of sowing wheat on limed fallows, being so frequently thrown out of the soil by the alternate frost, and fresh weather in the spring, and which often presents little more than half a crop of inferior wheat. Some change, there-

fore, in the rotation in this respect, or some other mode of application for the time, would be advisable. Mr Dudgeon of Prora suggests, that perhaps barley on the fallow, having been so little sown for many years past, would be extremely productive, but barley is a precarious crop without dung or some substitute, and the price of wheat is so much better, that until some change takes place in that respect, a different system can hardly be adopted. It is singular that this suggestion should correspond with the rotation most common in Essex, namely, 1. Fallow; 2. Barley; 3. Clover; 4. Wheat; 5. Barley or oats,—the dung being laid on the fallow for barley, and some on the clover for wheat. The Essex farmers have, it is said, found by long experience, that barley is a better crop after fallow, than wheat, the great pulverization that the soil receives during the fallow, being admirably calculated for that crop.

Seven years Rotation.

Some farmers have tried a rotation of seven crops. Mr Cunninghame, near Perth, who rents about L. 1200 *per annum*, has adopted the following course: 1. One-seventh potato and naked fallow; 2. Wheat; 3. Beans; 4. Wheat, when the season admits; 5. Barley; 6. Grass; 7. Oats, or sometimes a few acres after grass sown with wheat, after three furrows and a little dung.

Mr Allan of Craigcrook near Edinburgh has adopted the following rotation with success: 1. Fallow; 2. Wheat without dung; 3. Drilled Pease and Beans with dung, or Tares without dung; 4. Wheat; 5. Beans, or Tares with dung; 6. Wheat; 7. Beans and Tares.

Eight years Rotation.

The last rotation which it is necessary to point out, is a course of *eight crops*, an example of which has been transmitted to me by Mr Andrew of Tillilumb near Perth. His plan is, 1. Fallow or Potatoes; 2. Wheat; 3. Beans; 4. Wheat; 5. Barley; 6. Grass; 7. Oats; 8. Wheat; but he does not recommend this rotation except in situations where the ground is good, and of some strength, and where there is a command of town manure. His great object in following this plan is, to remove his grass crops at a great distance from one another, and he thinks they are so much the better. Last year he had a field in grass, the one half of which happened to be the fifth year from a former grass, and the other the eighth. That in the eighth year had nearly one-half more of grass upon it than the other, and this year he is persuaded that it will produce two bolls more of oats *per acre*, though they had been both equally dunged and dressed for the barley.

3.—*Of double Rotations.*

There is a mode of cropping to which I think the name of a *double rotation* may be given. It is where a particular course is laid down, but where part of the farm is alternately put under different crops, so as to prevent too frequent a repetition of the same sort of grain, on the same spot. Mr Wood of Milrig proposes, on that principle, to cultivate 1000 acres of convertible land, under the following system :

		<i>Acres.</i>		<i>Second Round of Cropping.</i>	
1. Summer-fallow, turnips and beans,	}	1st division, 200		2d divis.	
2. Wheat,		2d, —	200	3d, —	
3. Clover, one year old,		3d, —	200	4th —	
4. Clover, two years old,		4th, —	200	5th —	
5. Wheat and oats,		5th, —	200	1st —	
Total,			1000		

It is intended to shift the turnip and the bean allotments every time to different ground.

By sowing down with clover the second division annually, and breaking up annually the fourth, it comes into the place of the fifth, which is taken off regularly for summer fallow after the wheat and oats. It is thus placed into the first division, and of course changes all the divisions round, as often as that mode of agriculture is followed. By this means, the farm is always kept under the same crops, only the different divisions are changed alternately. Mr Wood considers this system as peculiarly calculated for farms at a distance from large towns, as all the divisions would be maintained in a high state of cultivation and fertility.

Another sort of double rotation is, where a part of a farm is preserved in grass for three, four or five years; then brought into the regular rotation, and another field taken out of it. An intelligent farmer, Mr Thomson at Bewlie in Roxburghshire, has adopted this plan with much success. His rotation upon the dry soil division of his farm is, 1. Turnips or fallow; 2. Wheat, barley, or oats; 3. Clover, partly cut and partly pastured; and,

4. Partly wheat, but principally potato, oats; but he has a fifth division which is kept in grass, and which is thrown out of the rotation for three, four or five years, and then brought in again; so that in the course of a twenty-one years lease, each division, in its turn, remains in grass for that period of time. In lands which are not naturally fertile and productive, this plan must be attended with very advantageous consequences. Every part of a farm thus derives a proportional share of the advantage of being kept in grass, which is infinitely preferable to the plan of preserving one part of a farm constantly in grass, and the other half in pasture.

4.—*Miscellaneous Particulars.*

There still remain some particulars, which it was difficult to comprehend under any of the preceding heads.

1. When any farm or district begins to be improved, it is necessary to commence with what may be called *gentle rotations*; that is to say, with crops not likely to exhaust the soil. When the late Earl of Findlater began his improvements in the county of Banff, every field was kept for four or five years in grass before any white crops were taken from it. The soil was thus enriched, and is now enabled to undergo more severe cropping. Fairley's rotation in Ayrshire was of the same description: the land was pastured with dairy stock *for six or nine years*; some dung or lime were then applied, and three successive crops of oats were taken; then a crop of hay, and afterwards the land was pastured as formerly. This system, though now reprobated, was suited to the times when it was established, and has laid the foundation of the present fertility of Ayrshire. Mr Church of Hitchell observes, that for moderate soils, ha-

ving no other manure than what they produce, these rotations must at first be extremely gentle, if ever they are intended to be put in a progressive state of improvement. Mr Park of Windy Mains, near Dalkeith, observes, that he is also under the necessity of adopting a gentle rotation, as his land is of very weak quality, originally all *outfield*, being mostly covered with whins and heath not many years ago.

2. It is remarked, that near towns, where adventitious manure may be obtained at pleasure, any fixed rotation, to be invariably followed, is not so necessary; on the contrary, that farmers, in such situations, ought to alter their systems, according as a demand is likely to arise for different articles.

3. Mr Drummond of West Bank, in the Carse of Gowrie, has tried flax on strong lands as a preparation for wheat, but he found that flax is by no means a sure crop in that description of soil, and that the succeeding crops were very deficient, although the ground got more manure. He found at the same time, that the wheat after flax was better in quality than after any other crop, but it was deficient in quantity about one-fourth, compared to wheat after fallow, and the after crops were still more so, in proportion.

4. It may be proper to conclude with observing, that in the opinion of a most intelligent agriculturist, (Mr Logan of Fishwick), farmers have been induced, in many parts of Scotland, from the high prices of corn, to plough too much; and there is reason to apprehend, that that great source of manure, namely stock, being neglected, sold off, or almost given up, that the soil will be exhausted by the severity and weight of cropping,—a circumstance, which in the course of a few years, must produce serious mischiefs. Importation being permitted,

grain cannot rise in price in proportion to the decrease of its produce, in consequence of the land not being freshened, and enriched by grass and stock. The result must be, that the price of stock will rise enormously on account of its scarcity, a circumstance that cannot be remedied under a succession of years: for first, the lands worn out must be fallowed, and laid down to grass; and next, stock must be bred for pasturing the land after it is laid down. The supply of Highland cattle has been much less than formerly, of course, the prices higher, which also will raise the price of other breeds. Another difficulty will also occur; farmers, who had excellent flocks of sheep of the Leicestershire breed, have rashly parted with them, for the purpose of turning their whole farms into tillage, and cannot get such flocks again, but at great expence, and after a lapse of years.

On the whole, the convertible system of husbandry is in general to be recommended, where one-half of a farm is in grain, and the other half in grass and green crops. By the grain, a sufficient quantity of straw is provided as food for cattle, where that mode of feeding is adopted, or for being converted into dung, in addition to a reasonable profit to be derived from the grain. By the grass and green crops, a number of cattle are well kept both in summer and winter; and being well littered as well as fed, a regular and sufficient supply of dung is secured. By this means also, the cattle are so well kept during the winter, that should a late spring ensue, or a scarcity of grass be apprehended, and consequently an overstocking, (an event which cannot be too anxiously guarded against by the farmer), a ready market will be insured for them*.

* Remarks by a farmer in the Mearns.

It is to be hoped, that with the assistance of the facts and observations above detailed, no farmer will find any difficulty in arranging his crops, so as to produce profit to himself, without injuring the fertility of his farm, or diminishing that great source of national prosperity and subsistence.

9.—HARVESTING GRAIN.

This is a point on which it is not proposed to dwell at any considerable length, but merely to detail any peculiarities in the Husbandry of Scotland, in regard, 1. To cutting down; 2. To carrying in; or, 3. To stacking the crop.

1. In Scotland, the crop is almost universally cut down by the sickle or hook, the scythe being very rarely used; and notwithstanding the liberal premiums offered by a respectable and public-spirited Institution, the Dalkeith Farming Society, no reaping machine has yet been invented, likely to answer the object in view. Indeed it is almost necessary to cut down with the sickle, where threshing-mills are in use, for the grain must either be regularly bound, where that operation is performed, or it must pass twice through the mill.

In many of the more fertile districts, bands from the Highlands, both male and female, flock down to reap the crops, receiving a certain sum *per* day, and their victuals, for the work they perform. In the Carse of Gowrie, the harvest was formerly performed by men and women hired expressly for that purpose; the men at a guinea, and the women 15 s. for the harvest; during which time

they got a breakfast and dinner of bread and beer, and one half lippie of oatmeal every day for supper, which they generally took up entire at the end of harvest. At that time the harvest used to cost about 5 s. *per* acre, including all expences. Some time after that, the harvest wages rose to 30 s. for the men, and 20 s. for the women, more or less, as the farmer and they could agree; but the expence was subject to variation, according to the price of meal, and the length of the harvest, from a favourable season, or the contrary, and it has been so high as 9 s. or 10 s. *per* acre. About fifteen or sixteen years ago, some men came to the Carse as contractors, and agreed to cut down the crops at so much *per* acre, but that plan did not continue long.

About six years ago, another practice took place in that district, which continues to this day. It is called *threaving*, and now almost universally prevails. By this plan the reapers are paid in money, without victuals, so much for every threave they cut down. For a threave of wheat, consisting of twenty-eight sheaves, each sheaf measuring thirty inches round, 4 d.; and for a threave of barley, oats, or pease, of twenty-four sheaves, each thirty inches round, 3 d.

This mode of harvesting is certainly of very great advantage to the country in general: for whole families turn out together, men, women, and children; they bring their provisions with them, remain in the field the whole day; the old teach the young to cut down; every one does something; and according to what they perform, they are paid. A hundred, or a hundred and fifty persons, young and old, may frequently be seen in a field at the same time, and besides the advantage of getting such a quantity of ripe corn cut down in a day, per-

haps it is an excellent school to fill the whole corn-field with good reapers or shearers *.

In order to train up reapers or shearers, an intelligent farmer, Mr Mitchell of Balquhain, puts four or five, according to their ability, on a separate ridge, and gives them, as an awkward squad, a sum in proportion to three on a common ridge.

Attentive farmers take special care to cut the crop very low; for by high cutting, besides the unavoidable waste, a great deal of manure is lost. By attending to this, and converting the straw into dung at a proper season, a sufficient quantity may be procured, to raise good crops of turnips, the greatest part of which being eat up on the ground by sheep, ensures a succession of good crops of grain till it falls again to be turnips.

2. Grain is now uniformly carried in by single horse, or two horse carts, to which limbers, shafts, or frames, are fixed, in order that the cart may convey a greater quantity of grain at a time. Carts in this way will easily carry at once from ten to twenty threaves, according to the size of the sheaves. In a note will be found the

* Communication from George Paterson, Esq; of Castle-Huntly. Another respectable correspondent from that district observes, that the growing crops of corn are now cut down by the threave. The wheat-threave consists of twenty-eight sheaves, each sheaf measuring thirty-six inches in girth, at the band; for cutting and binding of which, is paid in his neighbourhood 6 d. *per* threave. The barley, oats, and pease, or bean threave, consists of twenty-four sheaves, of thirty inches girth, for cutting and binding of which is paid 4 d. each threave. These dimensions of the sheaves are varied, according to the fancy of the farmer, and the price is either more or less, according as the size of the sheaf is increased or diminished. Hence what may cost 6 d. and 4 d. in one part of the district, may be charged only 4 d. and 3 d. in another.

different modes of making and fixing these frames *, which are found highly advantageous.

It is certain that carts are more easily managed than waggons; and that by using them, the operations of harvest go on more rapidly. When the carts come into the corn-yard, there are two modes of managing the grain. In some parts of the country, it is the common practice for the driver, to unyoke the horses, to turn up the cart, and then to return immediately to the field for another load. Another person, with a pitchfork, throws up the grain to the builder, and to prevent any corn from being lost, by being thrown off in this manner, there is commonly a large piece of canvas spread upon the ground, to receive it from the cart. In other parts of the country, it is customary for the driver to stand upon the top of the cart, and to fork the grain up to the builder. By the first of these methods, the man and his cart are not

* There are three different modes of fitting up the carts for harvesting grain or carrying hay. 1. By the first, the limbers or shafts, are fixed together by cross spars, and the upper framing mortised into the limbers. 2. Another method is, to fix the limbers together by cross spars, but the upper framing is fixed together separate from the limbers, and fixed upon them by screws. Both these plans are thought preferable to the first, because the shafts are not so much weakened by so many mortises cut in them, besides the advantage of the upper framing being easily taken off, so that the cart can at any time be made use of for carrying wood, large stones, &c. This frame will cost from L. 2 to L. 3, according to the quality of materials, and goodness of the workmanship. 3. A frame, called a hay-top, is occasionally fixed upon the common coup-cart, either with small ropes or iron-chains. These frames will cost from 15 s. to L. 1, 10 s. or L. 1, 15 s., according to the materials and quantity of iron-bolts made use of in fixing them together.—Communication from Mr Andrew Gray.

detained for any time. By the second, a person to fork up the grain is saved. Some farmers approve of the first method, and some of the latter.

3. It is well known, that with the exception of the celebrated barns at Inverary, where the Duke of Argyle is obliged, from the unceasing raininess of the climate, not only to preserve, but actually to dry his corn in large buildings erected for that special purpose, that the corn in Scotland is almost universally kept in stacks.

At Lord Haddington's seat at Tynninghame, the stacks are built on stone-pillars; which is found to be a very advantageous system. It takes nine pillars with capes to a stack. The price of these depends very much on the convenience of getting the stones. There they can be quarried, carted home, wrought, and put up, for about 3 s. each. It will require about twenty feet of timber to make the frame that goes on the pillars; the price of which also depends on the situation, and whether it can be got by short carriage. From the present high price of timber even there, including every expence, a complete set of nine pillars, and the timber necessary for a stack, cannot cost less than L. 3. The advantages resulting therefrom, when vermin is the object to be kept free from, may be about two bolls in thirty; but in a wet season, such as the last, (1809,) they are found very useful for drying the corn, when not put into the stack in the best condition, as they allow a free circulation of the air under, and the corn is not injured by imbibing moisture, as it must necessarily do, when set down on the ground in a wet state *.

* Communication from Mr David Buist, overseer at Tynninghame.

Near Alloa, they have invented cast-iron pillars for stacks, which seems to be a useful invention where stone cannot be had. These pillars are two and a half feet long, and the round bonnet on each end is one foot in diameter. After levelling the ground intended for the stack, so that all the seven pillars may stand plumb, and level on the top, they are placed on the level surface, and require neither building nor flag. Being placed in this way, they can be removed with very little trouble or expence. Vermin have also no way of getting up cast-iron pillars of the above description; and neither rat nor mouse have been found in any stack properly standing upon cast-iron pillars. The price of seven pillars is 50 s. and the frame, which is made of the very coarsest of timber, may be valued, (including workmanship and nails,) at 8 s.; so that one stack costs 58 s.*.

There is another invention, which I believe is peculiar to Scotland, called *bosses*. These, with cast-iron pillars, are admirably calculated for harvesting beans in wet seasons. The process is thus described. A triangle is first erected on the middle of the frame to hand on the cross binders of the frame, and which forms a boss of about three feet wide; railing must be nailed across the boss so close as to preserve the sheaves falling into the boss; but when railing is not at hand, a strong straw rope may be made to answer in its stead. After the binder has reached the top of the boss, he places therein a sack filled with straw, which, when he builds round, he pulls up until he reaches the top of the stack; so that by the vent left by

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* Communication from Mr John Laing, overseer at Tulibody.

the sack, the air reaches even to the top of the stack. As to the question, how soon beans can be put in, by means of bosses, that depends upon what state the beans were in when cut. It is therefore necessary to mention three different cases in which beans are cut: First, before either leaves or pods have changed their colour; if cut in this green state, they will require from fourteen to twenty days, in a bad season, with bosses, and twenty-eight without them. Secondly, when above half of the pods have turned yellow, and part of the leaves fallen off; when cut in this state, (which is thought much the best), they will require from seven to eight days with bosses, and fourteen without them. And, thirdly, when the pods have all turned blackish, and the leaves fallen off, in this state three or four days may do with bosses, and seven or eight without them. On the whole, it may be affirmed, that beans, by this mode may be harvested in half the usual time. It is supposed that the beans grow upon strong clay, or carse land; on dry land, they will require much shorter time in the stook.

Any thing that would tend so materially to improve our mode of harvesting beans and pease, (for the latter crop might be treated in the same manner), the culture of both of which is so desirable, is of the most essential consequence to Scottish Husbandry.

10.—THRESHING AND CLEANING GRAIN.

We next proceed to the process of separating the grain from the straw, and cleaning it afterwards, operations which have been carried, in Scotland, to a degree of perfection, altogether unrivalled in any other country *. In

* As a proof of the great number of threshing-mills and fanners erected in Scotland, it may be stated, on the autho-

regard to the first, many attempts have been made, at various times, for constructing machines competent to the task of threshing; but I am fully convinced, that had it not been for the superior ingenuity of Andrew Meikle, no threshing-mill would have been brought to any tolerable degree of perfection in our time. To him may be justly attributed the merit of the feeding-rollers, and the drum; the plan of the flax-mill having been adopted in other cases. Every friend to merit, must rejoice to hear, that the inventor of so important a machine, will be rendered comfortable in his old age, by the voluntary donations of his grateful countrymen*.

It is not intended, in this place, to give any description of the nature of the machinery, but it may be proper shortly to lay before the reader, 1. An account of the different powers used in driving the machine; 2. A short view of the advantages resulting from the invention; and, 3. Some hints regarding the improvements of which it is susceptible.

Threshing-mills are driven, 1. By horses; 2. By oxen; 3. By wind; 4. By wind or horses; 5. By water; 6. By water or horses; or, 7. By steam. Some small machines of this sort are driven by manual labour, but they do not merit any particular notice, and in general it is observed, that unless machines are of a strong and power-

rity of Mr Jack of Moncur, that in the Carse of Gowrie district alone, which is a tract of about fourteen miles long, and four miles broad, there are no less than 120 threshing-mills driven by horses, and ten by water; and that there is hardly a farm of any extent in Scotland without fanners. Millwrights also have now become a separate trade, or occupation, from other branches of mechanism.

* The history of the origin of the threshing-mill is very ably explained in the Farmer's Magazine.

ful construction, they are constantly going wrong, and require perpetual reparation *.

i. Where a command of water cannot be obtained, which is certainly the least expensive power that can be employed, *horses* are commonly made use of; and when the farms are rather of a moderate size, and where the horses are rarely employed in that labour, some farmers state, that they consider it rather advantageous than prejudicial to their health†; as they are worked also, only in bad weather, when other business out of doors could not be attempted, they consider the threshing by horses, as attended with little or no expence; but where the crop is large, and in particular where a considerable proportion of it consists of wheat, and where the machine is heavy, the labour must be severe. This additional la-

* Mr Neil Ballingal states, that the advantage of a mill, strong and well constructed, well managed, and with fanners, is of the greatest importance. But a slight mill, constantly breaking, and with no fanners, no farmer would accept of in a present.

† Mr Jack of Moncur, in the Carse of Gowrie, remarks, that he finds his horses, since threshing-mills have become universal, much fairer wrought, as they are every day at work, and he does not think the threshing, if the mill is of a good construction, an hurtful exercise for the horses in *winter*. Another farmer, (Mr Andrew of Tillilumb), observes, that he does not find much inconvenience in threshing his mill by horses, nor does he think the horses much, if any thing the worse for it, indeed he sometimes thinks them better, as he can thus give them regular exercise even in the worst days of winter. He adds, that since he has had a mill, he has not seen the smallest symptom of grease upon his horses. Mr Andrew's farm, however, only consists of about 110 Scotch acres, the labour, therefore, cannot be very severe.

bour, however, where other power cannot be applied, farmers consider to be indispensable *.

An intelligent farmer, Mr Blackie of Holydown, gives the following calculation of the number of horses required for the different crops. A four-horse mill he thinks is quite sufficient for oats or barley, but where there is much wheat, a six-horse power is required. A three-horses' power does very well for potato oats, when the corn is fed in by a careful hand; the mill then threshes much cleaner than a flail: But when the corn is put in faster than the mill is ready for it, the horses are oppressed, and the work not well done.

2. It is said that working threshing-mills by horses is a power so unsteady, and attended with so much destruction to them, and hence so expensive, that some farmers prefer the flail, to the erection and keeping up of the machinery and horses. Though such an idea seems to be carried much too far, yet it certainly would be desirable, to exempt the horses regularly working on the farm, from so laborious a task, and oxen have been recommended for that purpose.

A gentleman on the borders, who rents about L. 4000. *per annum*, informs me, that before he had collected water sufficient to thresh his crop, (which may be done much oftener than people are commonly aware of), he was accustomed, for many years, to thresh his crop by oxen; and he adds, that wherever there is a necessity for using animal power, he would recommend oxen, as they are

* Mr Neil Ballingal observes, that the horses, after being in a threshing-mill for about three quarters of an hour, and threshing as much straw as is necessary for the stock, amounting, in his case, to sixty or seventy head, will, after feeding, plough as well as if they had not been in the mill.

more steady in the machine than horses. His oxen, when employed in the threshing-mill, were fed in the usual way; only from being so near the shed, or court, they were unyoked in the middle of the day in winter, and got a few turnips, in lieu of the hay they were accustomed to get at mid-day, when employed in the field. A single tree was fixed to the beam, or what is commonly called the start of the mill, and the oxen were yoked to it by chains, in the same way as in the plough. For six or seven years, he never had a horse in the mill, and each ox was employed nearly three years, one out of three being annually laid off for feeding, and a young one trained in its place. When not employed in the threshing-mill, the oxen ploughed or harrowed as usual, and sometimes were employed in leading dung, turnips, &c.

The advantages of using oxen in threshing-mills, are represented in the strongest point of view by Mr Wood of Mill-Rig in Linlithgowshire.

In a communication to a useful institution, the Salton Agricultural Society, he observes, that threshing-machines are so much connected with the farming business, that it cannot be carried on without them. They are in general drawn by horses, and are found to be very injurious to that valuable animal; for which reason, he advertised some time ago, to have one made, to be driven by oxen, so as to suit their natural step. This he happily effected. For two seasons he threshed with oxen, and found, upon trial, both the mill and oxen to answer particularly well. It was thus in his power to have his threshing carried on, without interrupting any work wherein his horses are engaged, besides exempting them from the severe labour of threshing about 100 acres of wheat annually, which proved destructive to his horses, though they were very high fed. He found

oxen much superior to horses, being much more steady. It is necessary, however, that the driver should humour the ox in the mill, and that the machine should be made to go with more velocity, on account of the slower pace of the horse.

As a proof of the advantage of employing oxen, Mr Wood states, that he tried the following experiment. He put up twelve oxen into one court; they all had one sort of food, namely, as many turnips as served them, and as much straw as they could destroy, and were all in good condition when put in. Six of them were idle, the other six wrought in the mill. He turned all the twelve out at the same time upon young grass, and sold them off about the first week in July, in the public market in Edinburgh, and found the butchers always fixed upon the worked oxen as the fattest; it was of course evident, that their work had done them no harm. The whole were winter stock; their cost on an average was about eleven pounds, and they sold at seventeen guineas each. The wrought oxen, however, were a year older than the idle, which might help to make them feed faster. The next season, having betwixt sixty and seventy turnip cattle, the greater part of which were tied up early in October; he was under the necessity, therefore, of threshing soon after harvest, to have plenty of straw for litter, &c. He now found himself enabled, (his other farming work being well forward), to tie up his worked oxen to the stake, and they were sold, after being kept six weeks, for upwards of twenty guineas each. Their original cost was twelve guineas a head, about the last week in July, and they were fed on coarse land, till the threshing began, and then got turnip and straw. Hence it must be obvious, that this plan is attended with a profit; whereas, by using horses for

threshing, it is ultimately a great loss. The use of oxen, therefore, in this operation, may certainly be looked to, in some degree, as an improvement in agriculture. It is but fair to add, that for the first four or five times, the oxen are very awkward in the mill, and great care is then necessary to teach them; but after that, they go more steadily than horses.

Mr Andrew Gray makes the following observations on this interesting subject. Some persons are of opinion, that as oxen in general move very slow, hence, that much time and labour would be lost in working them. That, however, can be obviated, by altering the velocity of the machine. It is also doubted whether oxen are as proper as horses for walking in a circle. A farmer in the county of Moray, however, informs me, that he has used four oxen in a threshing mill, at one of his farms, and that he found they did equally well as horses; by which his plough-horses were eased, and the oxen he worked were kept in good condition, by turnips and straw: and as it has been found from long experience, that oxen, if properly trained, will work equally fair and pleasant with horses, either in the plough, the wain, or any other machine in which they move straight forwards*, it may therefore be presumed, that if taught, they will work equally fair when walking in the same circle, and though oxen in general move slower than horses, the threshing-machine can

* Horses will carry as well as draw; hence some of the load may be put on their back, and the horse is the better for it, more especially going up hill. Oxen, on the other hand, will draw, but cannot carry; tumbril carts, therefore, having three wheels, are the best for them. If oxen are apt to be giddy in a threshing-machine, they should be blind-folded, as horses sometimes are.

easily be so calculated, as to answer with their slower motion. It would therefore seem, that oxen are at least equal, if not superior to horses, for working threshing-machines. There are indeed some circumstances that appear to be in favour of oxen. It is well known, oxen are very steady and constant in the yoke, which is a very material property in any animal employed in machinery.

These are considerations which merit well the attention of every farmer in the kingdom; and it now can hardly be doubted, that for working in the threshing-mills, and other extra labour, a few oxen on a farm might be attended with infinite advantage.

3. The next power is *wind*, and if water cannot be got, it is contended, that a wind-mill is greatly superior to one wrought by horses. Wind-mills, it is said, are now so nicely constructed, that the sails contract and dilate, according as the wind increases or decreases; so that now the motion is much more uniform than that of a horse mill driven by the most careful driver. The next great advantage of the wind-mill is its great power, which permits more work to be done in the same time, and at less expence, as the ordinary servants on the farm are capable of threshing a sufficient quantity after having gone their yoking or journey at either cart or plough, during the winter months; besides, the expence of tear and wear of horses employed at the threshing-mill, is beyond calculation, as no work upon the farm is half so expensive*. Mr Rennie of Oxwell Mains considers, that a wind threshing-mill, equal to the power of eight horses, will annually save, when compared to horses,

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* Communication from Mr Rennie of Kinblethmont.

L. 40 *per annum*, deducting the sinking of **L. 200** additional expence, in the erection of the machine; and Mr Wilson of Simprin in Berwickshire, is of opinion, that wherever a great quantity of wheat is grown, the resistance is so great, and to overcome it is so ruinous to horses, that a threshing-mill ought to be driven either by wind or water.

Others object to wind-machines, on account of the expence of the erection, the uncertainty of their going in calm weather, and the danger attending them when the wind blows hard. Mr Brodie of Garwald, in particular, observes, that in hilly situations, the wind is apt to rise in such sudden squalls, as frequently to make that power inconvenient, and not unaccompanied by danger.

Mr Neil of Kelso informs me, that the expence of a good wind threshing mill will be about **L. 550**, and that when a horse power is annexed to it, the additional expence, according to the present price of timber, will be about **L. 120** more, or **L. 670** in all.

4. Aware of these objections to the power of wind alone, Mr Kennie of Fantassie, Mr Broun of Markle, and other respectable farmers, have erected threshing-machines, so constructed, as to be worked either *by wind or by horses*, as may be found necessary. They consider the power of wind to be so uncertain, that without the addition of horses, a great inconvenience would often be sustained. Mr Hume of East Barns has a machine of the same description, but owing to the vicinity of the sea, he has hardly ever had occasion for the horse power. He considers threshing-machines of great advantage, even with horses; but when wind or water can be obtained, it is worth, he states, on a farm of about 250 Scotch acres of arable land, from **L. 100** to **L. 200** *per annum*.

5. *Water* is by far the cheapest and the best power to be applied to threshing-mills. From the equality and the smoothness of the motion, the machine will last double the time to one drove by horses; and as water-mills generally do much more work when in motion, they do not require to be so frequently used *. It is calculated, that in threshing a crop of any extent, a pair of horses may be saved upon the farm, by the use of a water-mill, which is a great consideration.

Mr Stewart of Hilhead has a threshing-mill driven by water collected from springs in the upper part of his farm, and gathered in a dam. It has seldom been stopt for want of water, and then only in extreme frosts, when the ploughmen thresh, having little other work to do. Mr Stewart adds, that the barley is cleared of *awns*, by putting it through the mill with a grater upon it, which is done at the rate of three bushels in the minute. This seems to be a useful appendage to the threshing-mill.

6. Mr Hunter of Tynefield has a threshing-mill wrought *by water, and by horses*, when water is scarce. About half his crop is threshed by the water, which saves about 10 *per cent.* on the expence, whereas, by the labour of horses only, about 5 *per cent.* is gained. I consider this to be a very useful suggestion. There are many situations, where, by collecting springs, and forming dams, half the labour of threshing might be done by water, without much additional expence of machinery.

7. The last power to be applied is *steam*. It is said, that on some new plan, steam-engines have been invented at Hull, which would furnish power sufficient to drive a threshing-machine, at the expence of about

* Remarks by Mr James Cuthbertson.

L. 200 *. Where coal can be had at a moderate expence; some would reckon steam superior even to water; but as fire is always a dangerous enemy to straw, and farm-servants often careless, it may be sometimes attended with risk.

2. *Advantages of Threshing-mills.*

It is impossible to form an adequate idea of the advantages which have been derived from this important invention, without considering the manner in which threshing had been previously performed. There were two methods adopted for that purpose. The first was by a person who contracted to thresh the grain, giving twenty-four parts to the farmer, and reserving one twenty-fifth part to himself: The second method was, to hire a man to thresh the grain, at 1 s. 3 d. *per* boll. Both these modes evidently furnished an inducement to thresh the grain in a slovenly, rather than in a perfect manner; for the more labour that was bestowed on the threshing, the less was the profit derived from it. The mischief was, that by these methods, every part of the business was a distinct process. In the first place, as many hands were collected to bring in the stack, and to build it into one end of the barn, as would, with the advantage of a mill, bring in, thresh, and clean the one half of it, in the same time; next, the tasker had to take it from the mow, (as it is called), to lay it on the floor, to shake it well, and then to thresh it; and when each floor is threshed, he must put the straw out of his way; twice every day at least, he had to gather what corn he had

* Communication from Mr Brown of Cononsyth. Mr Freeman in Oxfordshire has erected a very large steam threshing-mill.

threshed from every corner of the barn, and to separate it distinctly from the straw; women had to attend twice a day to shake the straw, and men to carry it away; and last of all, hands were collected to clean and prepare it for market, after lying perhaps fourteen days on a cold clay floor. Instead of all this, with the mill, and at most nine hands, often with only six or seven, and from four to six horses, the farmer can bring in, thresh, and partly clean, on an average, twenty-four bolls in four hours, at the same time, shaking and disposing of the straw; and before the women leave the mill, it is ready for the market, the door locked, and the key in his possession. What a difference, instead of being a sort of slave to taskers for at least nine months in the year. A baker also, will give 2 s. *per* boll more for wheat threshed by a mill, than by the flail*.

The specific advantages resulting from this invention, may be thus stated. 1. The threshing and shaking are so much better performed than they were by the flail, and by the hand, as to justify the opinion, that there is an advantage derived, equal to one boll in twenty, over the old-fashioned methods†. The *foul threshing*, or grain left in the straw by the flail, was formerly so abominable, that a respectable farmer in the Carse of Gowrie, calculates, that to his certain knowledge, it was equal to the expence of keeping all the work-horses on his farm‡, and the loss was so insufferable, that the far-

* Communication from Mr Richard Somner of Gilchriston.

† Communication from Mr George Farme, Braidwood, near Dalkeith, and Mr Brown of Cononsyth.

‡ There is now no risk from foul-threshing, as every farmer can distinguish, in a few minutes, whether the work is

mer was afraid to go from home, for the eight months in the year during which the threshing lasted. 2. It is not only of importance, its being done in a much more perfect manner, but also, that it can be executed much more expeditiously *, in so much, that advantage may be taken of any sudden demand; a scarce market may be supplied; a stack of thirty to forty bolls may with ease be threshed in a day, and sent to market, or to the miller; and all this may be done during weather, when the other farming operations must be at a stand. 3. It has been well observed by Mr Broun of Markle, that, if in the large farms of this country, hand labour were to be used for separating corn from the straw, a farmer's whole attention would be taken up by barnwork, otherwise the work would be imperfectly executed; whilst much pilfering would go on, unless he was constantly on the watch †. At a threshing-machine, any thing of that kind can rarely happen, so many people being employed together when the machine is at work, constantly under the eye of the master, or of some confidential servant, and when the work is finished, every door is instantly

properly done or not; but by the flail, he was almost always at the mercy of the thresher, who grew so weary of so tedious an employment, that it is not to be wondered at he should execute it in a slovenly manner. Besides, the labour was an unwholesome employment, from the dust it was apt to raise, and those who worked at it seldom lived long.

* Once putting it through the hand-fanners, completes it either for the mill, or the merchant, and a stack can be threshed out, cleared, sacked, delivered, and might almost be ground, and baked into bread, in one and the same day.

† The doors of the barns formerly were almost constantly open.

locked. 4. One important advantage attending the threshing-machine, worked by any power, is the superior value of the grain; as the speedy way in which the work is executed, prevents that waste and damp, which was produced from the long continuance of the corn among the chaff, thereby rendering it not so fit for meeting the market, and of inferior quality to the consumer*. Hence, as Mr John Shirreff well observes, the corn, instead of lying during one, two, or even three weeks, amidst the chaff and other rubbish, in the corner of a barn, till it becomes quite raw to the touch, and musty to the smell, or, if the floor is damp, sometimes in part, springs, grain when threshed by the machine, is instantaneously separated from both straw and chaff, as well as every other extraneous substance, and can be immediately measured up into bags, to be disposed of as may best suit the owner's interest. So great is the difference between grain threshed by the flail and the machine, that any person acquainted with the article, may go through a corn market, blindfolded, and note every bag. 5. Another great advantage is, that the farmer can thresh his seed-wheat when in a soft state, recently cut and taken off the field, and without any injury what-

* Communication by Mr James Cuthbertson. Mr Peter Jack of Moncur, observes, that when grain was threshed by the flail, it was ten or twelve days in the floor, the first part of the grain lying on the floor so long, became damp and swelled, that though put to a proper granary, yet it soon became foisted, from the damp that it carried from the cold floor, and on that account, never had the fine flavour in flour, that meal of all kinds now have, never being suffered to lie on the barn floor. North country oats and meal often lose a market in the south, on account of the foisted taste, it is so apt to imbibe from damp floors.

ever, which, before the invention of mills, it was hardly possible to get executed, in the harvest time, without the greatest difficulty, and at a heavy loss. He is thus also enabled to provide seed-corn in the spring, which was not always an easy operation. When threshing for seed was done in a hurry, it may easily be supposed in how slovenly a manner the operation would be performed. In the busiest time of harvest also, straw can be got for covering stacks, which formerly could hardly be obtained.

6. It is found that strong wheat-straw is more useful for cattle when threshed in a mill, it is so much more softened than by the flail *. 7. If a stack of corn is brought from the field into the yard, too soon, and is heated, it is threshed in one day, goes to the kiln and suffers no loss; but before the invention of mills, when threshed by the flail, it was so soured that it was almost unsaleable, and a loss of perhaps 20 *per cent.* was thereby sustained.

8. Mr John Shirreff remarks, that by the threshing-mill, the separation of the grain from the straw, is not only more complete than by any other known means, but the separation of the straw from the grain and the chaff, by the rake, and of the chaff and small seeds from the grain, by the fanners and skreens, all driven by the same machinery, are advantages not inferior, perhaps, to the separation of the grain from the straw in the first instance.—Taking all these circumstances into consideration, and that prior to the invention of threshing-mills, drudgery, it may be said, stared the farmer in the face; and that besides heavy losses, it was the source of endless trouble and vexation to every occupier of land, it is not to be wondered at, that the threshing-mill should be considered

* Communication from Mr Peter Jack of Moncur.

the most useful and profitable instrument belonging to a farm, and that its advantages should be accounted INCALCULABLE.

Some estimates, however, have been made of the advantages to be derived from this invention, which one farmer calculates at the rate of 5 s. *per acre* *, whilst others state it at 5 s. *per acre*, with horse mills; but at full 10 s. *per acre* upon the whole lands under crop, when the machine is driven by water, by wind, or by oxen †. Mr Dudgeon of Primrose Hill, from general observation, without entering into minute calculations, is of opinion, that the aggregate advantage derived from a well constructed threshing-mill, wrought by water, and under proper management, (when compared with the old mode of threshing,) will be about 8 *per cent.* upon the corn threshed, including labour alone, but without making any allowance for money sunk in erecting the mill, or repairing the machinery. It is calculated by an intelligent farmer, that a threshing-mill, saves, on an average, the expence of three men for nine months, which, on a farm producing 1000 bolls, is equal to about L. 70, or 1 s. 3 d. *per boll*. Mr Dudgeon of Prora, has made a comparative estimate of the expence of threshing wheat by the mill and the flail, from which it appears that the saving of charges in threshing alone, independent of other advantages, though the work be performed by horses, and not by any cheaper power, is equal to 47 s. *per 50 bolls*, or 11 d. *per boll*.

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* Communication from Mr Charles Alexander of Easter Haprew.

† Communication from Mr Wood of Milrig.

*Comparative Estimate between the Threshing-Mill and
the Flail.*

Three pair of horses and the men, at 8s. *per* day for
each man and pair of horses ; hence for

50 bolls,	-	-	-	-	L. 1	4	0
Three additional men, at 2 s.	-				0	6	0
Four women at 9d.	-				0	3	0

Expende of threshing <i>per</i> mill,	L. 1	13	0
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Which, <i>per</i> boll, is	L. 0	0	7½
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Dressing the Corn.

	L.	s.	d.	
1 man at 2s. 2 days,	0	4	0	} 9s. or <i>per</i> boll,
3 women at 9d. do ,	0	4	6	
Oil and other contin- gencies, -	0	0	6	
				Tot. <i>per</i> boll,
Lot for threshing 50 bolls <i>per</i> flail, 2 bolls at 40 s.	L. 4	0	0	0 0 10
Expende of threshing as above <i>per</i> mill,	1	13	0	

Saved on 50 bolls, <i>per</i> mill,	L. 2	7	c, or 11 d.
			<i>per</i> boll.

When the price of grain is higher than 40 s. *per* boll,
the profit from the mill is still greater.

*Improvements on the Threshing-Mill *.*

It is probable that several improvements will still be made on this machine. Amongst these, diminishing the

* Mr Robert Ker states, that Mr Dun, a very ingenious mill-wright at Coldstream in Berwickshire, has made many useful improvements on threshing-mills, in particular on those which go by wind; more especially, by causing the machinery to regulate the sails in proportion to the wind and work, in a most effective manner, with no trouble whatever to the people who feed the mill. He has likewise adapted a series of buckets, resembling the chain-pump, which continually return all ill-threshed grain, particularly ill-humbled barley, to the threshing stage; and has, besides, added an ingeniously-devised shaker, beyond the rake, for clearing all the loose grain from among the straw. On the whole, the machines erected by Mr Dun, Mr Ker is of opinion, have carried the threshing mill to its utmost perfection; always supposing, however, that they possess sufficient moving power of water or wind; for they are rather too much loaded to be driven with any tolerable ease by horses.

The greatest objection to horse-machines, is the severity of labour which they require, besides often necessarily occupying the time of the farm draughts, when much wanted for other purposes. The capital defect of the threshing-mills which are driven by wind, is the extreme uncertainty of that power. During the long-continued frosts of winter, when there is hardly any wind, they are often altogether useless for weeks, when straw for litter and fodder cannot be dispensed with; and the same thing sometimes happens during harvest, when straw is much wanted for thatch. Water-mills, where that power can be had, are certainly the best in every respect; being more economical and steadier in their operation, than when driven either by horses or wind. But water is very apt to fail in autumn, and during long frosts. On these accounts, both wind and water machines, except when the latter have an ample and ready supply of the moving power, ought to be provided with horse wheels.

size of the drum, is certainly amongst the most important. The drum should not exceed from two feet eight inches to three feet. That able mechanic, Mr Andrew Gray, is decidedly of opinion, that a small drum, with few beaters, is preferable to the larger one with a great number, the small drum making better work,

Steam has been lately applied for the purpose of impelling threshing machines, and is not liable to interruptions; but there has not hitherto been sufficient experience to determine its comparative advantages and disadvantages. It is said that 12 cwt. of coals, are required to thresh out 50 Berwickshire bolls, or 300 bushels of wheat. It is probable, however, that the alternation of heating and cooling the steam apparatus, may occasion much loss and expence in repairing the furnace and boiler; and there is little chance, in districts merely rural, of being readily able to procure work-people who are sufficiently conversant in steam engines, for keeping the valves, leathers, and other parts of such nice machinery in order.

As to the expence of threshing, Mr Robert Ker is of opinion, that all the six horses in the mill, can easily be driven by one man, so that two of those in the preceding calculation may be deducted, which is equal to 4 s. of the whole expence. He also thinks, that one day is sufficient for dressing 100 bolls, after going through the threshing machine. On the whole, he makes the following estimate of the expence of threshing and dressing 50 bolls of wheat:

Three pair of horses at 6 s. <i>per</i> pair,	-	L. 0	18	0
Four men at 2 s. 6 d. each,	- - -	0	10	0
Four women at 1 s. each,	- - -	0	4	0
				<hr/>
		L. 1	12	0
Incidents, as oil, &c.	- - -	0	0	3½
				<hr/>
		L. 1	12	3½

which is at the rate of 7½ d. *per* boll.

In the wind or water machine, the expence of the horses is saved, by which the cost *per* boll is reduced to less than 3½ d. By means of the steam power, the cost is restored to nearly the same with horses.

not being so severe on the cattle, and less straining to the machinery. Although it is obvious that a drum three feet diameter, having four beaters, must take two revolutions for one of the drum six feet diameter, with eight beaters, it is evident that the circumference of the one will move with the same velocity as the other, because one turn of the large drum is equal to two turns of the small one, therefore they will give an equal number of strokes in the same time ; but it is found by experience, that the small drum threshes much cleaner, or makes better work than the larger one. The small drum is therefore to be preferred ; being easier driven, it must be less severe on the cattle, and by its striking the corn at a more acute angle, of course strips off the grain much cleaner from the straw *.

Another great improvement is, that of making horses work equally, to obtain which object, a plan has lately been invented by Mr Walter Samuel, a smith near Edinburgh, the apparatus of which is simple, and cheap, not exceeding 20 s. *per* horse, by means of which all the horses must equally exert themselves in the machine ; a discovery for which the inventor deserves to be rewarded.

* Mr Wood of Milrig remarks, that he has always found the moderate sized threshing-mill by far the most useful, and less destructive to the animals which drive it, and sufficiently expeditious for the purpose of any farm ; and by employing a certain number of day labourers, which a farm of proper size has always at command, and by employing the ox for threshing, your horses, and the men belonging to them, are never taken from other agricultural purposes, very necessary perhaps to be carrying on at the same time.

Another improvement is, instead of two fluted rollers, to have one of them plain, but chipt cross-ways, about half an inch deep in various places. This prevents the straw from rolling around the other fluted roller; in which case the straw must be immediately cut, otherwise much mischief may be done. This is supposed to be a Scotch invention, for it was introduced into Northumberland only in the year 1807. When chipped, the straw adheres to the roller, without lapping round it, which it is apt to do, when fluted, if the straw is damp.

When horses are yoked in threshing-mills, they ought either to have goggles, or to be blinded, as they are so apt to look back. All horses should have breechings to enable them to stop the machine, and many have been killed, and much mischief done, owing to the want of so essential an article. The lever ought always to be placed above the horse's back.

Great diversity of opinion is entertained regarding the kind of threshing-mill that is easiest wrought, some contending for two movements, some for three, and others for four. Mr Rennie of Fantasie recommends a mode of trial which he thinks would set that matter to rest, that of having three or four models of different movements, but of equal power, to be constructed by an able mechanic, and these to be wrought by means of weights, which he thinks would at once ascertain which of them had the easiest draught; at the same time, it would be difficult to say, with any degree of correctness, which ought to be preferred. So much depends on a variety of circumstances; as, 1. The strength, quality and condition of the horses; 2. The length and stiffness of the straw; 3. The ripeness of the grain; 4. Its being well or ill filled; 5. Its being dry or damp; 6. The experience

and ability of the driver, and feeder; and lastly, The condition in which the machine is kept *.

As to the charge of erecting threshing-mills, the expence, in the Carse of Gowrie, is calculated at L. 200 for each machine, including the horse-shed, the fanners and the loft connected with the framing of the machinery, but exclusive of the barn, the barn lofting, &c. †. This expence is likely to increase, owing to the increased value of wood, but Mr John Shirreff remarks, that that must in some degree, be counterbalanced, by the present more general introduction and employment of cast-metal segments and pinions, in the construction of which, much labour is saved, and consequently wages to the operative mill-wright.

Upon the whole, after the experienced advantage of powerful threshing-mills on large farms, they have now become not only most useful, but almost indispensably necessary appendages; and farmers who have been accustomed to the dispatch, security, and economy, which they contribute to the management of extensive concerns, would find themselves reduced to most unpleasant inconvenience, should any circumstances oblige them to have again recourse to the flail.

* Communication from George Rennie, Esq; of Fantassie.

† Communication from Mr Peter Jack of Moncur.

On Fanners.

This excellent instrument is more generally to be found in Scotland than even the threshing-mill. By using it, with the aid of riddles in some part of the operation, all dust, chaff, and other refuse are blown away, and the grain separated into divisions according to its quality, by which it is rendered intrinsically more valuable, than if the good and the bad were mixed together; in the same manner as a fleece of wool is more valuable, when broken or sorted by the wool-stapler *. Some years ago, religious people, attached to old habits, refused to winnow with the *deil's wind*, as they called it; but every scruple of that sort, is now given up. The threshing-mill has generally one set of fanners attached to it, driven by a belt from the end of the axle of the threshing drum; but where the machine is driven by horses, the working of a second pair, for cleaning the grain completely, is rather found to be severe upon them: the second pair of fanners is therefore generally driven by hand. Mr Dudgeon of Primrose Hill states, that one of his neighbours has got a small water-wheel, totally unconnected with the threshing machinery, for driving the second fanner, which, by affording a steady equable motion, separates the light grain in the most complete style †. By some improve-

* There is an excellent account of the fanning process in Kerr's Berwickshire.

† Mr Cuthbertson finds, that the two pair of fanners attached to his water threshing-mill perform their work so well, that oats or beans are completely finished for market; wheat and barley, however, require an additional dressing by the hand-fanners.

ments in the late erected machinery, it is said, that hand fanners are rendered unnecessary, and that the cleaning of the grain is completed, at the same time that it is threshed, so that the grain may be measured into the sacks. This would indeed be an essential improvement. At the same time, owing to the inequality of motion necessarily attendant on the operation of threshing, the second fanner, for separating the light grain from the good, will not accomplish the purpose intended, in a perfect manner, if it goes at the same time with the mill,

END OF PART SECOND.

*The Third Part will be Printed and Circulated
as soon as possible.*

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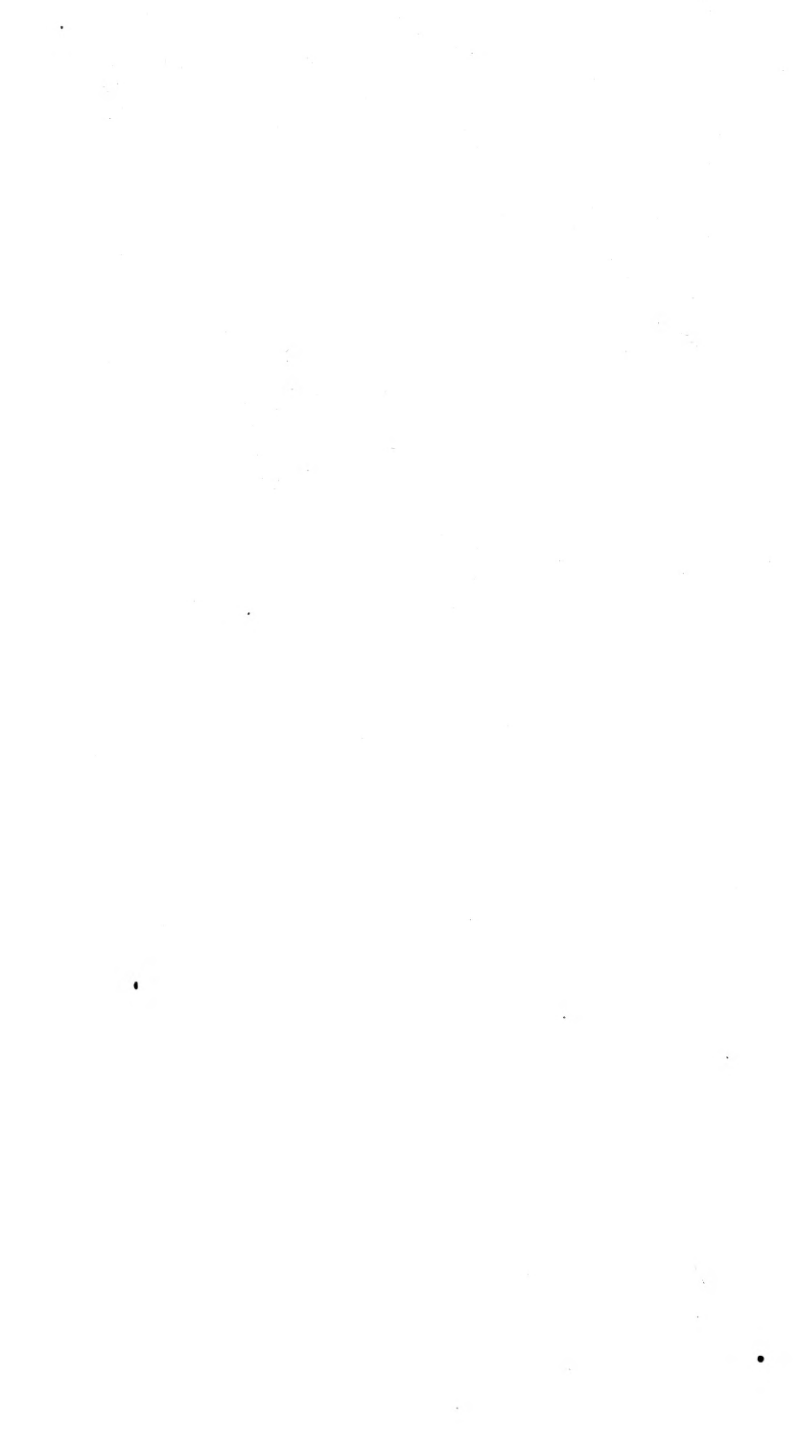
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